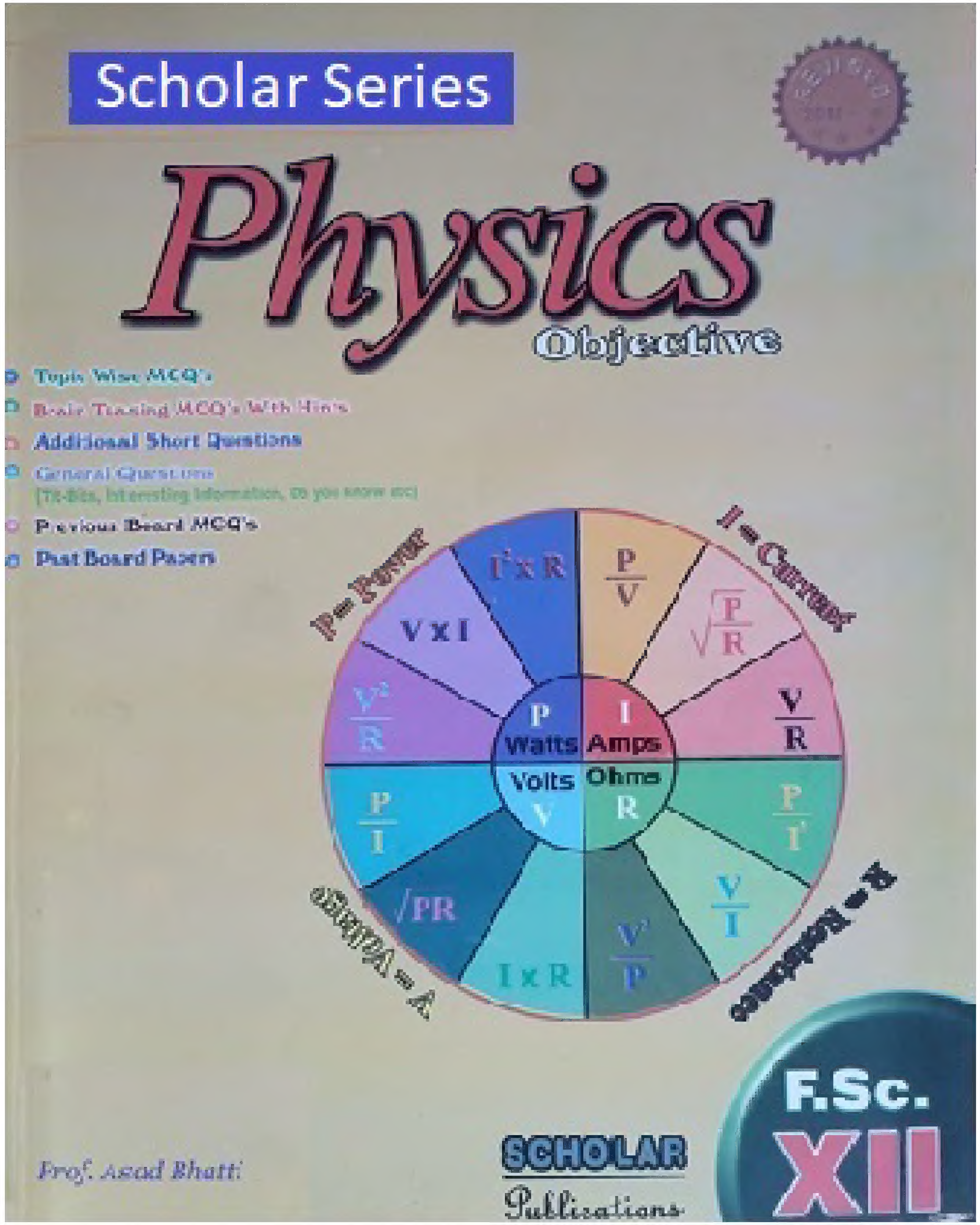


12TH HELPING BOOK PDF

Chapter 12 ELECTROSTATICS

Topic Wise MCQ's

- Four possible answers to each statement are given below. Tick (✓) the correct answer.

Coulomb's Law

1. The study of electric charges at rest under the action of electric force is known as
   (a) electrostatics (b) electrodynamics
   (c) electronics (d) electromagnetism
2. If the distance between two point charges is reduced to half, the force becomes
   (a) 2times (b) ¼ times
   (c) 4times (d) ½ times
3. Unit of relative permittivity is
   (a) Nm^2C^{-1} (b) No unit
   (c) $C^2N^{-1}m^{-2}$ (d) $Nm^{-2}C^{-2}$
4. If the electric force between two charges is one newton, then the charges are
   (a) alike (b) unlike
   (c) positively charged (d) none of these
5. Electric constant (k) is the
   (a) force between two point charges of same magnitude
   (b) small number of bounded electrons
   (c) large number of free electrons
   (d) small number of free electrons
6. Unit of charge is
   (a) ampere-sec (b) coulomb
   (c) both a and b (d) joule

The number of electrons in one coulomb charge is equal to
[Hint : q= ne]

(a) 6.25×10^{18} (b) 1.66×10^{-19}
(c) 6.25×10^{21} (d) 9.1×10^{-31}

Coulomb's law holds only for

(a) medium charges (b) large charges
(c) point charges (d) all of these

coulomb's force is

(a) mutual force (b) non-conservative force
(c) weaker than gravitational force (d) all of these

In SI units, the value of permittivity of free space (ε_o) is

(a) $9\times10^{9}\ C^2 N^{-1} m^{-2}$ (b) $8.85\times10^{-12}\ C^2 N^{-1} m^{-2}$
(c) $9\times10^{-9}\ C^2 N^{-1} m^{-2}$ (d) $8.85\times10^{12}\ C^2 N^{-1} m^{-2}$

The value of electrostatic constant k (i.e., $\frac{1}{4\pi\varepsilon_o}$) is

(a) $9\times10^{-9}\ Nm^2 C^{-2}$ (b) $9\times10^{9}\ Nm^2 C^{-2}$
(c) $8.85\times10^{-12}\ Nm^2 C^{-2}$ (d) $8.85\times10^{12}\ Nm^2 C^{-2}$

The value of coulomb's constant k depends upon

(a) the system of units used only
(b) medium between the charges only
(c) quantity of the charges only
(d) the system of units and the medium between the charges

The relative permittivity of air ε_r has value equal to

(a) 9×10^{9} (b) 8.85×10^{-12}
(c) 1.0 (d) 1.0006

If the distance between two charges is doubled, the electric force between them will become

(a) half (b) twice
(c) four times (d) one fourth

If 2C charge is given to two oppositely charged bodies having charge 2C each, then force between them becomes

(a) four times (b) one fourth

(c) double (d) zero

16. If the distance between two point charges in free space is increased to double, value of electric constant becomes

(a) 2 times (b) ½ times
(c) ¼ times (d) remains some

17. The electrostatic force of repulsion between two electrons lying at a distance of 1 m is

(a) 2.3×10^{28} N (b) 2.3×10^{-28} N
(c) 9×10^{9} N (d) 8.85×10^{-12} N

18. The value of ε_r for various dielectrics is always

(a) greater than unity (b) less than unity
(c) equal to unity (d) none of these

19. When an insulator (i.e., dielectric) is placed between the charges, the force between the charges, as compared to vacuum

(a) increases (b) decreases
(c) remains constant (d) none of these

20. The electrostatic force of repulsion between two charges of magnitude 1C each lying at a distance of 1 m is

(a) 9×10^{-9}N (b) 9×10^{9}N
(c) 8.85×10^{-12}N (d) none of these

21. Coulomb's law is in accordance with Newton's

(a) first law (b) second law
(c) third law (d) none of these

22. Coulomb's electrostatic force is

(a) conservative (b) repulsive
(c) attractive (d) all of these

Fields of Force, Electric Field Lines

23. The concept of electric field theory was introduced by

(a) Dalton (b) Kepler
(c) Newton (d) Michael Faraday

24. Michael Faraday introduced the concept of

(a) gravitational force
(b) magnetic force
(c) electric field

(d) all of these

25. The force per unit charge at a point in an electric field known as
(a) electric flux (b) electric intensity
(c) electric potential (d) electron volt

26. Electric field intensity at a point is defined by the relation
(a) $E = \frac{q}{F}$ (b) $E = \frac{F}{q^2}$
(c) $E = \frac{F}{q}$ (d) $E = Fq$

27. SI unit of electric field intensity is
(a) coulomb (b) newton/coulomb
(c) volt (d) ampere

28. The direction of electric field intensity is
(a) perpendicular to the direction of field
(b) along the direction of force
(c) opposite to the direction of force
(d) none of these

29. A charge at rest creates around it
(a) electric field (b) magnetic field
(c) both (a) and (b) (d) none of these

30. Which one of the following quantities is vector?
(a) work (b) electric potential
(c) speed (d) electric field intensity

31. If a charge of 10 μC experience a force of 10^{-2} N at a point, then electric intensity at that point is:
(a) 10^3 N/C (b) 10^{-3} N/C
(c) 10^2 N/C (d) 10^{-2} N/C

32. The magnitude of electric intensity due to point charge q at a distance r in free space is
(a) $\frac{1}{4\pi\varepsilon_o}\frac{q}{r}$ (b) $\frac{1}{4\pi\varepsilon_o}\frac{q^2}{r}$
(c) $\frac{1}{4\pi\varepsilon_o}\frac{q}{r^2}$ (d) $\frac{1}{4\pi\varepsilon_o\varepsilon_r}\frac{q}{r}$

33. The electric intensity at infinite distance from the point charge is
(a) zero (b) infinite
(c) 1N/C (d) none of these

34. Test charge is always a unit
(a) negative charge (b) positive charge
(c) negative point charge (d) none of these

35. The electric intensity at the mid point of the line joining the two like charges of same magnitude is
(a) zero (b) positive
(c) maximum (d) negative

36. The force on an electron in an electric field of magnitude 10^6 N/C is
(a) 1.6×10^{-19} N (b) 1.6×10^{19} N
(c) 1.6×10^{-13} N (d) 1.6×10^{13} N

37. The electric intensity at a point 3 cm from a charge of 90μC is
(a) $90 \times 10^7\ NC^{-1}$ (b) $90 \times 10^{-7}\ NC^{-1}$
(c) $30 \times 10^7\ NC^{-1}$ (d) none of these

38. The electric lines of force for a positive sheat of charge
(a) are real lines
(b) imaginary lines
(c) emerge perpendicular to the surface of charge particle
(d) both b & c

39. Electric field will be uniform if field lines are
(a) equally spaced (b) parallel
(c) both a and b (d) radial

40. The strength of the field at any point is known as
(a) electric flux (b) electric intensity
(c) electric potential (d) all of these

41. The direction of field lines around a positive point charge is
(a) radially outward (b) radially inward
(c) circular (d) along the tangent

42. The direction of field lines around a negative point charge is
(a) radially outward (b) radially inward
(c) circular (d) along the tangent

43. The lines of force never be
(a) parallel (b) closer
(c) intersect (d) all of these

44. The electric field lines from a charge emerge in
(a) one dimension (b) two dimensions
(c) three dimensions (d) none of these

45. The electric lines of force between two like (similar) charges
(a) repel each other (b) attract each other
(c) intersect each other (d) none of these

46. Number of electric lines that can be drawn from a point charge is
(a) three (b) six
(c) infinite (d) none of these

47. If we move away from a charge, the magnitude of electric intensity will
(a) increase (b) decrease
(c) remains constant (d) none of these

48. N/C is not the unit of
(a) electric intensity (b) electric flux
(c) electric potential (d) both b & c

49. The electric field can not deflect
(a) α-particles (b) β-rays
(c) protons (d) neutrons

Applications of Electrostatics

50. "Xerography" means
(a) printing (b) writing
(c) wet writing (d) dry writing

51. Identify the practical applications of electrostatics
(a) inkjet printing (b) xerography
(c) powder coating (d) all of these

52. Heart of photo copier is
(a) heated rollers (b) toner
(c) drum (d) all of these

53. The drum in a photocopier is coated with a layer of
(a) aluminium (b) selenium
(c) gold (d) silver

54. A special dry, black power which is spread over the drum of photocopier is called
(a) photo powder (b) tuner
(c) toner (d) neutralizer

55. The inkjet print head ejects a steady flow of
(a) positive ink droplets (b) negative ink droplets
(c) ink droplets (d) none of these

56. During photocopy, the dark areas of document retain their
(a) positive charges (b) negative charges
(c) both charges (d) none of these

57. An inkjet printer in its operation uses:
(a) neutrons (b) protons
(c) electric charge (d) all of these

Electric Flux, Gauss's Law and Its Applications

58. The number of electric field lines passing through a certain element of area is called
(a) electric flux density (b) electric flux
(c) electric intensity (d) electric potential

59. Dot product of electric intensity and plane vector area element is called
(a) electric flux density (b) electric flux
(c) electric intensity (d) electric potential

60. Electric flux is a:
(a) vector quantity (b) scalar quantity
(c) vector with no dimension (d) none of these

61. Electric flux is zero, when area is held ______ to electric field
(a) at angle of 45° (b) parallel
(c) perpendicular (d) at angle of 60°

62. Electric flux is maximum when area is held ______ to field
(a) perpendicular (b) parallel
(c) parallel (d) at angle of 60°

63. Flux passing through an area $\overline{A}$ will be positive, when angle between $\overline{E}$ and $\overline{A}$ w[...] be
(a) greater than 90° (b) less than 90°

(c) equal to 90° (d) none of these

64. SI unit of electric flux is:
(a) $N^2 m^2 C^{-1}$ (b) $N^2 m C^{-1}$
(c) $Nm^2 C^{-2}$ (d) $Nm^2 C^{-1}$

65. The electric flux through any surface depends upon
(a) area of the surface
(b) direction of the surface relative to the field
(c) the intensity of the electric field
(d) all of these

66. Total electric flux ϕ through a closed surface having a charge 'q' at its centre is
(a) $\phi_e = E/A$ (b) $\phi_e = \frac{q}{\varepsilon_o}$
(c) $\phi_e = \frac{F}{q}$ (d) $\phi_e = K\frac{q}{r^2}$

67. Electric flux through a closed surface depends upon
(a) shape of the surface
(b) area of surface
(c) charge enclosed
(d) medium and charge enclosed

68. The closed surface where Gauss's law is applied is called
(a) rectangular surface (b) circular surface
(c) gaussian surface (d) all of these

69. According to Gauss's law, the flux(ϕ_e) through a closed surface is proportional to [Q is the charge enclosed]
(a) $1/Q$ (b) Q^2
(c) Q (d) $\sqrt{Q}$

70. Gauss's law can only be applied to:
(a) an open surface (b) a closed surface
(c) a curved surface (d) a plane surface

71. Intensity of electric field inside a hollow metallic charged sphere will be:
(a) maximum (b) zero

(c) unaffected (d) negative

72. The electric field intensity due to an infinite sheet of charge is:
(a) $\vec{E} = \frac{\sigma}{2\varepsilon_o}\hat{r}$ (b) $\vec{E} = \frac{2\sigma}{\varepsilon_o}\hat{r}$
(c) $\vec{E} = \frac{1}{2\sigma\varepsilon_o}\hat{r}$ (d) $\vec{E} = \frac{\sigma}{\varepsilon_o}\hat{r}$

73. The electric intensity between two oppositely charged plates is:
(a) $\vec{E} = \frac{\sigma}{2\varepsilon_o}\hat{r}$ (b) $\vec{E} = \frac{\varepsilon_o}{\sigma}\hat{r}$
(c) $\vec{E} = \frac{\sigma}{\varepsilon_o}\hat{r}$ (d) $\vec{E} = \frac{\sigma}{\varepsilon_o\varepsilon_r}\hat{r}$

74. The surface charge density is defined as:
(a) $\sigma = qA$ (b) $\sigma = \frac{q}{A}$
(c) $\sigma = \frac{A}{q}$ (d) $\sigma = \frac{q}{\varepsilon_o}$

75. Electric intensity between two oppositely charged plates is uniform at
(a) central region (b) edges
(c) any where outside plates (d) none of these

76. Electric intensity between two equal and like charged plates is
(a) σ/ϵ_o (b) $\sigma/2\epsilon_o$
(c) zero (d) $2\sigma/\epsilon_o$

77. The electric flux through a plane area will be half of its maximum value when area is held at angle of _______ with electric field
(a) 30° (b) 45°
(c) 60° (d) none

Electric Potential, Electron Volt, Charge on a Electron by Millikan's Method

78. The work done in moving a unit positive charge from one point to another against the electric field is a measure of:
(a) capacitance (b) resistance

(c) potential difference (d) electric intensity

79. Work done per unit charge is called
(a) electric flux (b) electric potential difference
(c) electric intensity (d) all of these

80. The SI unit of potential difference is
(a) volt (b) J/C
(c) coulomb (d) both a and b

81. The product of charge and potential difference is:
(a) flux (b) current
(c) energy (d) power

82. Electric potential is a:
(a) vector quantity (b) scalar quantity
(c) neither scalar nor vector (d) fixed quantity

83. The earth's potential is considered as:
(a) negative (b) positive
(c) zero (d) infinite

84. 1 volt/meter is equal to:
(a) 1 joule/meter (b) 1 coulomb/meter
(c) 1 newton/coulomb (d) 1 coulomb/newton

85. joule / coulomb is the unit
(a) electric potential (b) electric potential energy
(c) electric intensity (d) Both a & b

86. The electric field as a potential gradient can be expressed as:
(a) $E=\frac{W}{q_o}$ (b) $E=\frac{\Delta V}{q_o}$
(c) $E=-\frac{\Delta r}{\Delta V}$ (d) $E=\frac{-\Delta V}{\Delta r}$

87. V / m is the unit of
(a) potential gradient (b) electric intensity
(c) potential difference (d) both a & b

88. Work done is bringing a unit positive charge from infinity to a point in an electric field is called.
(a) electric intensity (b) absolute potential

(c) potential gradient (d) potential energy

89. The electric potential is constant through out a region of space, the electric field in this region will be
(a) maximum. (b) negative
(c) zero (d) infinite

90. Sharks can detect the potential difference of the order of.
(a) milli-volts (b) micro-volts
(c) nano-volts (d) pico-volts

91. Electric potential is the characteristic of
(a) electric field (b) electric charge
(c) both a & b (d) none

92. Two equal and opposite charges are separated by distance d. Then at a point mid way between them
(a) $V = 0, E = 0$ (b) $V \neq 0, E = 0$
(c) $V \neq 0, E \neq 0$ (d) $V = 0, E \neq 0$

93. Electron volt is the unit of
(a) potential difference (b) potential gradient
(c) electric energy (d) electric intensity

94. The potential at a point situated at a distance of 10 cm from a charge of 10 μC is
(a) 9×10^6 V (b) 9×10^5 V
(c) 9×10^{-6} V (d) 9×10^{-5} V

95. The magnitude of the electric field between two separated plates can be calculated by the relation
(a) $E = V/d^2$ (b) $E = V/d$
(c) $E = Vd$ (d) $E = d/V$

96. One electron volt (eV) is equal to
(a) 1.6×10^{19} J (b) 1.6×10^{-19} J
(c) 1.6×10^{19} C (d) 1.5×10^{-19} C

97. One joule is equal to
(a) 1.6×10^{-19} eV (b) 1.6×10^{19} eV
(c) 6.25×10^{-18} eV (d) 6.25×10^{18} eV

98. A particle carrying a charge of 2e falls through a potential difference of 3.0 V. The energy acquired by it will be:

(a) 6.0 eV
(b) 9.6×10^{-19} J
(c) both (a) and (b)
(d) 6.0J

99. If a charged body is moved against the electric field it will gain
(a) elastic potential energy
(b) kinetic energy
(c) gravitational energy
(d) electric potential energy

100. In Millikan's oil drop method, the oil droplet is suspended between plates if
(a) qE = mg
(b) E = mg
(c) qE = g
(d) q = mg

101. A charge of 10 C is accelerated through a potential difference of 100 V, it will acquires energy equal to
(a) 10 J
(b) 100 J
(c) 1000 J
(d) 10000 J

102. The electrostatic force as compared to the gravitational force is
(a) very strong
(b) very weak
(c) Zero
(d) equal

103. It can be shielded
(a) gravitational force
(b) electric force
(c) both a and b
(d) none of these

104. Electrostatic force is:
(a) attractive
(b) repulsive
(c) mutual force
(d) all of these

105. Electrostatic force is
(a) medium dependent
(b) conservative
(c) obeys inverse square law
(d) all of these

106. Millikan devised a technique for the measurement of the charge on an
(a) proton
(b) electron
(c) neutron
(d) α-particle

107. The charge on the droplet in Millikan experiment is calculated by using the formula
(a) q = mg/dV
(b) q = V/mgd
(c) q = mgd/V
(d) q = d/mgV

108. In Millikan's method, in order to calculate mass of droplet, electric field is
(a) increased
(b) decreased
(c) Kept constant
(d) Reduced to zero

109. In Millikan's experiment, the oil drop can be suspended between two plates when gravitational force is equal to
(a) magnetic force
(b) nuclear force
(c) electric force
(d) none of these

110. In Millikan method each drop has the charge of
(a) same value
(b) different value
(c) integral multiple of a minimum value
(d) zero value

Capacitor And Capacitance, Electric Polarization of Dielectrics, Energy Stored in Capacitor' Charging And Discharging of A Capacitor

111. Capacitor is a device used for storing
(a) direct current
(b) electric charges
(c) alternating current
(d) A.C voltage

112. The unit of capacitance is
(a) farad
(b) coulomb
(c) ohm
(d) ampere

113. The capacitance of a capacitor is given by
(a) C = QV
(b) $C = \frac{Q}{V}$
(c) $C = \frac{V}{Q}$
(d) $C = \frac{1}{2}QV^2$

114. The ability of a capacitor to store charge is called as
(a) conductance
(b) inductance
(c) capacitance
(d) resistance

115. The capacitance of a capacitor depends upon the
(a) geometry of the plates
(b) medium between the plates
(c) separation between the plates
(d) all of these

116. Coulomb / Volt is the unit of
(a) current
(b) capacitance
(c) conductance
(d) resistance

117. For a capacitor, the charge per unit volt is called

(a) charge density (b) dielectric constant
(c) capacitance (d) permittivity

118. A capacitor is a perfect insulator for
(a) direct current (b) alternating current
(c) both (a) and (b) (d) none of these

119. When a dialectic is placed between the two plates of a charged capacitor which one of the following quantity changes:
(a) electric field (b) potential difference
(c) surface charge density (d) All of these

120. When a dialectic is placed between the two plates of a charged capacitor which one of the following quantity decreases does not change
(a) electric field (b) potential difference
(c) capacitance (d) charge

121. 1 pico-farad is equal to
(a) 10^{-3} farad (b) 10^{-6} farad
(c) 10^{-9} farad (d) 10^{-12} farad

122. The effective capacitance is reduced when capacitors are connected in
(a) series (b) parallel
(c) series-parallel combination (d) none of these

123. 1farad is equal to
(a) 10^{-5} microfarad (b) 10^{9} microfarad
(c) 10^{+12} picofarad (d) 10^{-15} microfarad

124. A capacitor of capacitance 2μF is connected with a battery of 12 volt, the charge stored is equal to:
(a) 2.5×10^{-5} C (b) 2.4×10^{-6} C
(c) 2.4×10^{-5} C (d) 2.4×10^{5} C

125. If a dielectric is placed between the plates of a capacitor, its capacitance:
(a) decreases (b) increases
(c) remains constant (d) none of these

126. Doubling the distance between the plates of a capacitor, the capacitance:
(a) increases to double (b) decreases to half
(c) remains constant (d) decreases to one – fourth

127. If the medium between plates of a capacitor be air or vacuum, then the capacitance of capacitor is:
(a) $\frac{A\varepsilon_o}{2d}$ (b) $\frac{A\varepsilon_o}{d}$
(c) $\frac{Ad}{\varepsilon_o}$ (d) $\frac{2A\varepsilon_o}{d}$

128. If an insulating material called dielectric is introduced between the plates, the capacitance of capacitor is:
(a) $\frac{A\varepsilon_o\varepsilon_r}{2d}$ (b) $\frac{A\varepsilon_o\varepsilon_r}{d}$
(c) $\frac{Ad}{\varepsilon_o\varepsilon_r}$ (d) $\frac{2A\varepsilon_0\varepsilon_r}{d}$

129. The capacitance of a capacitor can be increased by
(a) increasing the area of the plates
(b) increasing the distance between plates
(c) placing dielectric between them
(d) both a & c

130. Dielectric constant ε_r can be defined as
(a) C_{vac}/C_{med} (b) C_{med}/C_{vac}
(c) $C_{vac} + C_{med}$ (d) $C_{med} - C_{vac}$

131. If 2μF and 4μF capacitors are connected in series, the resultant capacitance is
(a) 6μF (b) 8μF
(c) 1.3μF (d) 0.5μF

132. If 2μF and 4μF capacitors are connected in parallel, the resultant capacitance is
(a) 6μF (b) 8μF
(c) 1.3μF (d) 0.5μF

133. The energy stored in the capacitor is:
(a) K.E. (b) Gravitational P.E.
(c) electric K.E. (d) electric P.E.

134. If a 2μF capacitor has a charge of 20μC, the potential difference between the plates is:
(a) 10V (b) 20V
(c) 40V (d) 50V

135. When a dialectics is placed between the two plates of charged capacitor which one of the following quantity increases:

(a) electric field (b) potential difference
(c) Charge (d) none of these

136. Due to polarization of the dielectric, the capacitance of the capacitor:
(a) increases (b) decreases
(c) remains constant (d) becomes zero

137. Due to polarization of the dielectric, the electric intensity between the plates of a capacitor:
(a) increases (b) decreases
(c) remains constant (d) becomes zero

138. Two equal and opposite equal charges separated by small distance are said to make a:
(a) super conductor (b) LED
(c) dipole (d) insulator

139. The energy stored in a charged capacitor is given by:
(a) $\frac{1}{2}CV^2$ (b) $\frac{1}{2}C^2V$
(c) $\frac{1}{2}Q^2V$ (d) $\frac{1}{2}QV^2$

140. Which one of the following relations for the energy stored in capacitor is not correct?
(a) $\frac{1}{2}CV^2$ (b) $\frac{1}{2}Q^2/C$
(c) $\frac{1}{2}QV$ (d) none of these

141. If the potential difference across the two plates of a parallel plate capacitor is doubled then its energy stored in it will be:
(a) 2 times (b) 4 times
(c) 16 times (d) remains same

142. In a charged capacitor, the energy resides in:
(a) the negative plate
(b) the positive plate
(c) both the negative and positive plates
(d) the field between the plates

143. The product of resistance and capacitance is
(a) velocity (b) force

(c) acceleration (d) time

144. Time constant is defined as the time during which a capacitor charges to_____ of its equilibrium value.
(a) 63% (b) 0.63 times
(c) 37% (d) both a and b

145. The speed of charging and discharging of a capacitor depends upon the product of resistance and
(a) current (b) charge
(c) capacitance (d) potential difference

146. Working of wipers of a car is a practical application of
(a) LC-circuit (b) RL-circuit
(c) RLC-circuit (d) RC-circuit

147. 1 ohm × 1 farad is equal to
(a) 1 ampere (b) 1 coulomb
(c) 1 second (d) 1 joule

148. In RC series circuit the time during which the capacitor acquires 0.63 times the equilibrium charge is known as
(a) time constant (b) decay constant
(c) electric constant (d) none of these

149. If time constant in RC circuit is small, the capacitor is charged or discharged
(a) slowly (b) rapidly
(c) at constant rate (d) none of these

Answer Key's

1.	(a) electrostatics	2.	(c) 4 time
3.	(b) No unit	4.	(a) alike
5.	(a) force between two point charges of same magnitude	6.	(c) both a and b
7.	(a) 6.25×10^{18}	8.	(c) point charges
9.	(a) mutual	10.	(b) $8.85 \times 10^{-12}\ C^2 N^{-1} m^{-2}$
11.	(b) $9 \times 10^9\ Nm^2 C^{-2}$	12.	(d) the system of units and the medium between the charges

13.	(d) 1.0006	14.	(d) one fourth
15.	(d) zero	16.	(d) remains same
17.	(b) 2.3×10^{-28} N	18.	(a) greater than unity
19.	(b) decreases	20.	(b) 9×10^{9} N
21.	(c) third law	22.	(d) all of these
23.	(d) Michael Faraday	24.	(c) electric field
25.	(b) electric intensity	26.	(c) $E = \frac{F}{q}$
27.	(b) Newton/ coulomb	28.	(b) along the direction of force
29.	(a) electric field	30.	(d) electric field intensity
31.	(a) 10^{3} N/C	32.	(c) $\frac{1}{4\pi\varepsilon_o}\frac{q}{r^2}$
33.	(a) zero	34.	(b)
35.	(a) zero	36.	(c) 1.6×10^{-19} N
37.	(a) 90×10^{7} NC^{-1}	38.	(d) both b and c
39.	(c) both a and b	40.	(b) electric intensity
41.	(a) radially outward	42.	(b) radially inward
43.	(c) intersect	44.	(c) three dimensions
45.	(a) repel each other	46.	(c) infinite
47.	(b) decrease	48.	(d) both b and c
49.	(d) neutrons	50.	(d) dry writing
51.	(d) all of these	52.	(c) drum
53.	(b) selenium	54.	(c) toner
55.	(c) ink droplets	56.	(a) positive charges
57.	(c) electric charge	58.	(b) electric flux
59.	(b) electric flux	60.	(b) scalar quantity
61.	(b) parallel	62.	(a) perpendicular
63.	(b) less than 90°	64.	(a) $N^2\ m^2\ C^{-1}$
65.	(d) all of these	66.	(b) $\phi_e = \frac{q}{\varepsilon_o}$
67.	(d) medium and charge enclosed	68.	(c) Gaussian surface

69.	(c) Q	70.	(b) a closed surface
71.	(b) zero	72.	(a) $\vec{E} = \frac{\sigma}{2\varepsilon_o}\hat{r}$
73.	(c) $\vec{E} = \frac{\sigma}{\varepsilon_o}\hat{r}$	74.	(b) $\sigma = \frac{q}{A}$
75.	(a) central region	76.	(c) zero
77.	(a) 30°	78.	(c) potential difference
79.	(b) electric potential difference	80.	(d) both a and b
81.	(c) energy	82.	(b) scalar quantity
83.	(c) zero	84.	(c) 1 Newton/ coulomb
85.	(a) electric potential	86.	(d) $E = \frac{-\Delta V}{\Delta r}$
87.	(d) both a & b	88.	(b) absolute potential
89.	(c) zero	90.	(c) nano-volts
91.	(a) electric field	92.	(d) V = 0, E ≠ 0
93.	(c) electric energy	94.	(b) 9×10^{5} V
95.	(b) E = V/d	96.	(b) 1.6×10^{-19} J
97.	(d) 6.25×10^{18} eV	98.	(c) both a and b
99.	(d) electric potential energy	100.	(a) qE = mg
101.	(c) 1000J	102.	(a) very strong
103.	(b) electric force	104.	(d) all of these
105.	(d) all of these	106.	(b) electron
107.	(c) q = mgd/V	108.	(d) reduced to zero
109.	(c) electric force	110.	(c) integral multiple of a minimum value
111.	(b) electric charges	112.	(a) farad
113.	(b) $C = \frac{Q}{V}$	114.	(c) capacitance
115.	(d) all of these	116.	(b) capacitance
117.	(c) capacitance	118.	(a) direct current
119.	(d) all of these	120.	(d) charge

121.	(d) 10^{-12} farad	122.	(a) series
123.	(c) 10^{12} Pico farad	124.	(c) 2.4×10^{-5} C
125.	(b) increases	126.	(b) decreases to half
127.	(b) $\frac{A\varepsilon_o}{d}$	128.	(b) $\frac{A\varepsilon_o\varepsilon_r}{d}$
129.	(d) both a and b	130.	(b) C_{med}/C_{vac}
131.	(c) 1.3μF	132.	(a) 6μF
133.	(d) electric P.E.	134.	(a) 10V
135.	(d) none of these	136.	(a) increases
137.	(b) decreases	138.	(c) dipole
139.	(a) $\frac{1}{2}CV^2$	140.	(d) none of these
141.	(b) 4 times	142.	(d) the field between the plates
143.	(d) time	144.	(d) both a and b
145.	(c) capacitance	146.	(d) RC-circuit
147.	(c) 1 second	148.	(a) electric constant
149.	(b) rapidly		

Brain Teasing MCQ's (with Hints)

◆ Four possible answers to each statement are given below. Tick (✓) the correct answer:

1. Which of the following is the dielectric constant of metals?
   (a) Zero (b) One
   (c) Infinity (d) greater than one but finite

2. Two charges q_1 and q_2 are placed in vacuum at distance d and force between them is F. If a medium of relative permittivity 4 is introduced between them then new force will be

   (a) $\frac{F}{4}$ (b) $\frac{F}{2}$
   (c) 2F (d) 4F

3. A charge Q is divided into two parts q_1 and q_2. The maximum coulomb repulsion between the two parts is obtained when ratio $\frac{q_1}{q_2}$ is.
   (a) 1 (b) $\frac{1}{2}$
   (c) $\frac{1}{4}$ (d) $\frac{2}{3}$

4. A metallic ball having charge 10^{-8}C moves from a point A at potential 600V to a point B at zero potential. Which of the following is the change in its K.E.
   (a) 6×10^{-6} erg (b) 6×10^{-6} J
   (c) 6×10^{6} J (d) -6×10^{6} J

5. Electric field and electric potential inside hollow charged conducting sphere are respectively.
   (a) zero, non zero (b) non zero, zero
   (c) $0, \frac{1}{4\pi\epsilon_o}\frac{q}{r^2}$ (d) $\frac{1}{4\pi\epsilon_o}\frac{q}{r^2}, \frac{1}{4\pi\epsilon_o}\frac{q}{r}$

6. Two point charges are +2C and +6C repel each other with a force of 12N. If a charge of –4C is given to each of these charges, the force now is
   (a) Zero (b) 4N repulsion
   (c) 4N attractive (d) 12N attractive

7. Two copper spheres of same radii one hollow and other solid are charged to the same potential then.
   (a) Both will hold same charge (b) Solid will hold more charge
   (c) Hollow will hold more charge (d) Hollow can not be charged

8. The magnitude of an electric field E, such that an electron placed in it would experience an electric force equal to its weight, is given by
   (a) mge (b) $\frac{e}{mg}$
   (c) $\frac{me}{g}$ (d) $\frac{mg}{e}$

9. When 10^{14} electron are removed from a neutral metal sphere then which of the following is the charge on sphere?
(a) $16\mu C$ (b) $-16\mu C$
(c) $32\mu C$ (d) $-32\mu C$

10. Which of the following is not the energy stored between the plates of a condenser?
(a) $U = \frac{CV^2}{2}$ (b) $U = 2qV$
(c) $U = \frac{q^2}{2C}$ (d) $U = \frac{qV}{2}$

11. Which material sheet should be placed between the plates of a parallel plate capacitor in order to increase its capacitance?
(a) Mica (b) copper
(c) tin (d) Iron

12. A capacitor is charged to store energy U. the charging battery is disconnected. An identical capacitor is now connected in parallel to the first capacitor. The energy in each capacitor is .
(a) $\frac{3U}{2}$ (b) U
(c) $\frac{U}{2}$ (d) $\frac{U}{4}$

13. Three capacitor of $4\mu F$ each are to be connected in such a way that the net capacitance is $6\mu F$. Then
(a) All the three be in series (b) All the three be in parallel
(c) Connect two in series and one in parallel.
(d) Connect two in parallel and one in series.

14. When air is replaced by a dielectric medium of relative permittivity ϵr, the maximum capacity of the condenser ______
(a) Decrease ϵ_r times (b) Increase ϵ_r times
(c) Increase ϵ^2_r times (d) remains unchanged

15. If a charged capacitor is connected to earth its charge.
(a) Decrease (b) Increase
(c) remain same (d) none of above

16. Time constant of fig (a). is t. which of the following is time constant of fig (b).

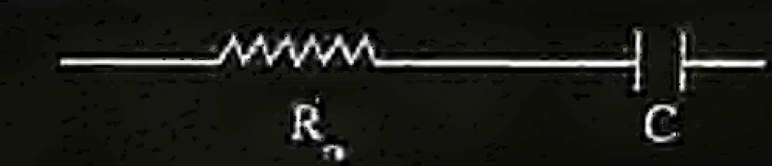
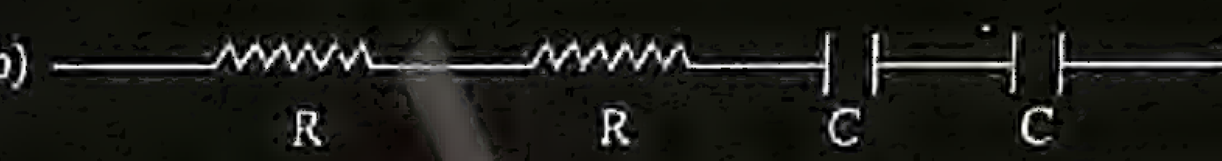
Fig (a)


Fig (b)


(a) 4t (b) 2t
(c) t (d) $\frac{t}{2}$

17. If a metal plate is placed between two point charges then electrostatic force between them.
(a) remain constant (b) increase
(c) decrease (d) become zero

18. An alpha particle is accelerated through potential difference of 10^6V. Which of the following is its K.E?
(a) 1MeV (b) 2MeV
(c) 4MeV (d) 8MeV

19. A parallel plate capacitor with oil between the plate ($\epsilon_r = 2$) has a capacitance "C". If oil is removed then capacitance of capacitor becomes.
(a) C (b) $\frac{C}{2}$
(c) $\frac{C}{\sqrt{2}}$ (d) $\sqrt{2C}$

20. A parallel plate capacitor is first charged and then a dielectric slab is introduced between the plates. Which of the following quantity remain unchanged?
(a) Energy (b) Capacity
(c) Potential (d) Charge

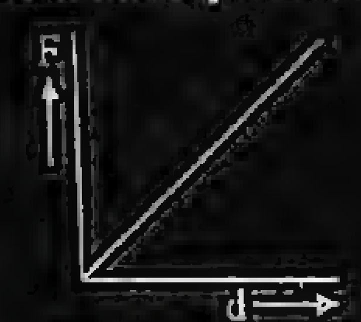
21. A 1 μF capacitor is subjected to 4000V potential difference the energy stored in capacitor is:
(a) 8J (b) 16J
(c) 4×10^{-3}J (d) 12×10^{-3}J

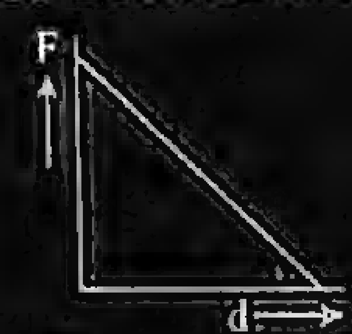
22. A charge Q is enclosed in a dielectric of strength K the maximum number of electric lines of force are
(a) zero (b) $\frac{Q}{\epsilon_0}$

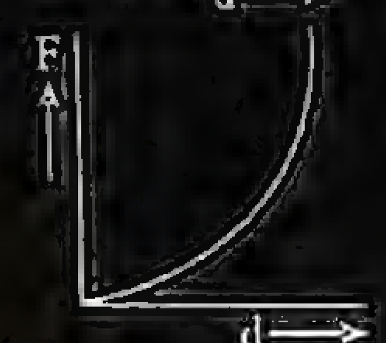
(c) $\frac{Q}{K\epsilon_o}$ (d) Infinite

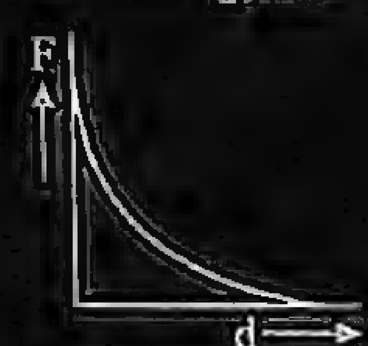
23. 4×10^{20} eV energy is required to move a charge of 0.25 C from A to B the potential difference between A and B is
(a) 178 V (b) 256 V
(c) 356 V (d) 400 V

24. Which of the following graph represents the relationship between the force between two point charges and distance between them?

(a) 

(b) 

(c) 

(d) 

25. When electron is brought near a –vely charged plate then its electrical P.E.
(a) increase (b) decrease
(c) remain same (d) become zero

Answer with Hints

No.	Correct Option	Answers	Hint
1	c	infinity	
2	a	$\frac{F}{4}$	$F_{med} = \frac{F_{vac}}{\epsilon_r} = \frac{F}{4}$
3	a	one (1)	
4	b	6×10^{-6} J	$\Delta V = 600 - 0 = 600V$ $q = 10^{-8}C$ $\Delta K.E = q\Delta V = 10^{-8} \times 600$ $\Delta K.E = 6 \times 10^{-6}$ J
5	a	zero, non zero	

6	c	4N attractive	New charges $q_1 = -2C$ & $q_2 = 2C$ $F \propto q_1q_2$ F = 4N As q_1q_2 are opposite charges therefore force is attractive.
7	a	Both will hold same charge	
8	d	$\frac{mg}{e}$	$F_e = w$ $eE = mg$ $E = \frac{mg}{e}$
9	a	16μC	$n = 10^{14}$ $q = ne$ $q = 10^{14} \times 1.6 \times 10^{-19}$ $q = 16 \times 10^{-6}C = 16\mu C$
10	b	2qV	As $U = \frac{1}{2}qv = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$ Therefore 2qv is not the energy stored in capacitor
11	a	mica	
12	d	$\frac{U}{4}$	As $U = \frac{Q^2}{2C}$ When charge reduces half then from above eq energy reduces one forth
13	c	Connect two in series and one in parallel	
14	b	Increase ϵ_r times	$C_{med} = C_{vac}\epsilon_r$
15	a	decrease	
16	c	t	in fig (b) $R_{eq} = 2R$

			$C_{eq} = \frac{C}{2}$ $R_{eq} \times C_{eq} = 2R\left(\frac{C}{2}\right)$ $= RC$ $= t$
17	d	become zero	$F_{med} = \frac{F}{\in_r}$ For metal $\in_r = \infty$ $F_{med} = \frac{F}{\infty} = 0$
18	b	2 Mev	$K.E = q\Delta v$ $q = 2e = 2 \times 1.6 \times 10^{-19}C$ $\Delta V = 10^6 V$ $K.E = 2 \times 1.6 \times 10^{-19} \times 10^6 J$ $K.E = \frac{2\times1.6\times10^{-19}\times10^6}{1.6\times10^{-19}}$ ev $K.E = 2 \times 10^6 ev$ K.E = 2Mev
19	b	$\frac{C}{2}$	$C_{vac} = \frac{C_{med}}{\in_r}$
20	d	charge	
21	a	8J	$U = \frac{1}{2}CV^2$ $C = 1\mu F = 1 \times 10^{-6}F$ $V = 4000V$ $U = \frac{1}{2} \times 1 \times 10^{-6}(4 \times 10^3)^2$ $U = \frac{16\times10^{-6}\times10^6}{2}$ $U = 8J$

22	c	$\frac{Q}{K\in_0}$	
23	b	256V	$W = 4 \times 10^{20} ev$ $W = 4 \times 10^{20} \times 1.6 \times 10{-}19J$ $q = 0.25C$ $\Delta V = \frac{W}{q} =$ $\frac{4\times10^{20}\times1.6\times10^{-19}}{0.25}$ $\Delta V = 256V$
24	d		
25	a	increase	

Additional Short Questions

1. Is coulombs electrostatic interaction consistent with Newton's third law of motion?

Ans. Yes, The force exerted by two charges are equal in magnitude and opposite in direction. If q_1 and q_2 are alike (similar) point charges placed at a distance r then from fig

$$\overrightarrow{F_{21}} = -\overrightarrow{F_{12}}$$

Two forces are equal in magnitude and –ve sign show that the forces are opposite in direction i-e. They obey the third law of motion.

2. Why is it safe to stay inside an automobile during a light storm?

Ans. Although many people believe that this is safe because of the insulating rubber tyre but this is not true. Lighting is able to travel trough several kilometer of air, so it can certainly penetrate a few centimetre of rubber.

The interior of the car is safe because the charges on the car's metal shell reside on its outer surface. Thus the occupant in the automobile touching the inner surface is not in danger.

3. What are the factors on which the capacitance of parallel plate capacitor depends?

Ans. Capacitance of a capacitor depends on the following factors.

(i) Shape or geometry of the plates
(ii) Area of the plates
(iii) Distance between the plates
(iv) Dielectric between the plates.

4. If the distance between two point charges is doubled and their individual charges are also doubled, what will happen to the force between them?

Ans. $F = k\dfrac{q_1q_2}{r^2} \longrightarrow (1)$

When distance is doubled $r' = 2r$

individual charges are doubled $q'_1 = 2q_1$

$$q'_2 = 2q_2$$

$$F' = k\frac{q'_1q'_2}{r^2}$$

$$F' = k\frac{(2q_1)(2q_2)}{(2r)^2}$$

$$F' = \frac{4kq_1q_2}{4r^2}$$

$$F' = k\frac{q_1q_2}{r^2} \longrightarrow (2)$$

From eq (1) & (2)

$F' = F$

Force will remain same

5. What are important functions of capacitor?

Ans. (i) Timer (Time setting in almost all automatic device)
(ii) Time base circuit in CRO
(iii) LC oscillators
(iv) Tuner circuit in radio and T.V.
(v) Integrating and differentiating circuits.
(vi) Voltage multipliers
(vii) In A.C. motors to enhance torque.

6. What are the limitations of coulombs law?

Ans. (i) Coulomb's law can be applied for point charges only.
(ii) Coulomb's law is applicable to charges at rest
(iii) Coulomb's force hold good for very small distance, up to about 10^{-13}m. When the distance become less, then 10^{-13}m. Then coulomb's force is dominated by nuclear forces.

7. Discuss the situation when electric potential at a point is zero ut electric intensity is not zero.

Ans. At the mid point between two equal and opposite charges electric potential is zero but electric intensity is not zero.

$$V_+ = \frac{1}{4\pi\epsilon_0}\frac{q}{d}$$

$$V_- = \frac{1}{4\pi\epsilon_0}\left(\frac{-q}{d}\right)$$

$$V = V_+ + V_- = \frac{1}{4\pi\epsilon_0}\frac{q}{d} - \frac{1}{4\pi\epsilon_0}\frac{q}{d} = 0$$

8. What are similarities between electrostatic force and gravitational force?

Ans. The two forces are similar in the following aspects

(i) Both obey the inverse square law $\left[F \propto \dfrac{1}{r^2}\right]$.
(ii) Both the forces are conservative forces.
(iii) Both the forces are central forces.
(iv) The two forces act along the line joining the two charges or two masses.

9. State the Coulomb's law of electro-statics?

Ans: It states that the force of attraction or repulsion between two point charges is directly proportional to the product of the magnitudes of charges and inversely proportional to the square of the distance between them.
Mathematically if q_1 and q_2 be changes and distance between then is 'r' then,

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

(Grw 2008)

10. What is meant by relative permittivity or dielectric constant?

Ans. Relative permittivity or dielectric constant can be defined as the ratio of electrostatic force between the charges in the absence of medium to the force when the medium between the charges is dielectric Mathematically,

$$\varepsilon_r = \frac{F_{vac}}{F_{med}}$$

11. **What is the effect of medium between the charges upon Coulomb's force?**

Ans. If an insulating medium (i.e. dielectric) is placed between the charges, then it will reduce the electrostatic force as compare to free space by a factor ε_r called relative permittivity.

$$F = \frac{1}{4\pi\varepsilon_o \varepsilon_r} \frac{q_1 q_2}{r^2}$$

12. **What is the origin of electric force and how it is transmitted from one charge to another?**

Ans. The origin of electrostatic force is still unknown that is why it is referred as force of nature. But its transmission can be described according to the concept of electric field described by Faraday. That is why this is reffered as force of nature.

13. **Define electric intensity. What is its SI units?**

Ans. Electric field strength or electric field intensity E at any point is defined as the force F experienced by a test charge q_o placed at the point. It is a vector quantity.

Mathematically, $\vec{E} = \frac{\vec{F}}{q_o}$

Or $\vec{E} = \frac{1}{4\pi\varepsilon_o} \frac{q}{r^2}\hat{r}$

It is measured in newton per coulomb (NC^{-1}) or volt per meter (Vm^{-1})

(Grw 2006, Mir Pur 2006)

14. **Write the properties of electric field line.**

Ans. (i) Electric field lines start from positive charges and end on negative charges.
(ii) The tangent to a field line at any point gives the direction of electric field at that point.
(iii) Number of electric field lines represent the strength of electric field at certain area.
(iv) No two electric lines cross each other.
(v) The lines of force do not exist inside the conductor.
(vi) Field line is always normal to the surface of change distribution.
(vii) If the field lines are parallels and equally spaced then the field is surd to be uniform.

15. **Determine the electrostatic force of repulsion between two electrons at a distance of 1m apart.**

Ans. According to Coulomb's law

$$F = \frac{1}{4\pi\varepsilon_o} \frac{q_1 q_2}{r^2}$$

Where $\frac{1}{4\pi\varepsilon_o} = k = 9 \times 10^9\ Nm^2C^{-2}$

As $q_1 = q_2 = e = 1.6 \times 10^{-19}C$

So $F = \frac{9\times10^9 \times 1.6\times10^{-19} \times 1.6\times10^{-19}}{(1)^2}$

$F = 23.04 \times 10^{-29}N$

16. **Find the magnitude of electric intensity at a point, distance of 100cm from a charge of 10 µC.**

Ans. As $E = \frac{1}{4\pi\varepsilon_o}\frac{q}{r^2}$

Where $k = \frac{1}{4\pi\varepsilon_o} = 9 \times 10^9\ Nm^2C^{-2}$

$r = 100cm = 1m$, $q = 10\mu c = 10 \times 10^{-6}C = 10^{-5}C$

Thus $E = \frac{9\times10^9 \times 10^{-5}}{(1)^2}$

$E = 9 \times 10^4\ NC^{-1}$

17. **How can we differentiate between uniform and non-uniform electric field?**

Ans. The electric field such as where the field lines are parallel and equally spaced is said to be uniform. If the electric field lines are not parallel or equally spaced then such a field is called non-uniform electric field.

18. **What is Xerography? Give its principle.**

Ans. Xerography is Greek word which is derived from Xero and Graphos meaning dry writing.

It is practical application of electrostatic, used in the making of photo copying machine.

Principle:

Photo conduction is the basic principle of xerography. According to which the selenium will conduct when it is exposed to light otherwise selenium will behave like an insulator.

(Rwp 2006)

19. **Define the vector area?**

Ans. The physical quantity whose magnitude is equal to the area of surface but direction be outward normal is called vector area. (denoted by $\bar{A}$)

20. **Define electric flux and give its SI unit.**

Ans. The number of field lines passing through a certain element of area is known as electric flux through that area. It is denoted by ϕ_e. It is a scalar quantity.

The SI unit of electric flux is Nm^2C^{-1}

(Lhr 2008)

21. **State the electric flux in terms of scalar product.**

Ans. The scalar product of electric field strength and vector area is called electric flux.

Mathematically $\phi = \vec{E}.\vec{A}$ (Grw 2005, Mtn 2005)

22. **What will be the effect of the shape or geometry of a closed surface on the electric flux passing through it?**

Ans. As electric flux through a closed surface is given by:

$$\phi_e = \frac{q}{\varepsilon_o}$$

which shows that total flux through a closed surface depends upon the medium and the charge enclosed by that surface, so it does not depend upto the shape or geometry.

23. **State Gauss's law and give its uses.**

Ans. According to Gauss's law, the electric flux through any closed surface is $\frac{1}{\varepsilon_o}$ times the total charge enclosed in it.

Mathematically, it is written as

$$\phi_c = \frac{1}{\varepsilon_o} \times Q$$

It is used to find electric flux through a closed surface and to find the electric field strength. (Fsd 2006, Lhr 2009)

24. **What is Gaussian surface?**

Ans. We can calculate the electric intensity with the help of Gauss's law. We consider an imaginary closed surface of arbitrary shape which passes through the point at which electric intensity is to be evaluated. This closed surface is known as Gaussian surface.

25. **Define electric potential in terms of electric potential energy?**

Ans. Electric potential of a point in an electric $\Delta V = \frac{\Delta U}{q_o}$ field is the potential energy per unit positive charge at that point.

26. **What is SI unit of potential difference? Also define it.**

Ans. SI unit of potential difference is volt.

volt: If a work of one joule is done in moving one Coulomb charge from one point to the other, keeping electrostatic equilibrium then the potential difference is said be one volt.

$$\text{So } 1 \text{ volt} = \frac{1\text{joule}}{1\text{coulomb}}$$

27. **Define the term potential gradient.**

Ans. Potential gradient is defined as "the maximum rate of change of potential electric in magnitude and direction with respect to the displacement in an electric field."

Mathematically, $E = -\frac{\Delta V}{\Delta r}$

The negative sign shows that the direction of $\vec{E}$ is along the decreasing potential. (Mtn 2006)

28. **What is the difference between electrical potential energy and the electrical potential difference?**

Ans. (i) Electric potential energy is defined as the energy stored in the charge 'q' because of its position in an electric field.

Electric P.E. $= U = q_o \Delta v$

(ii) Electric potential difference between two points is defined as the work done in moving a unit positive charge from one point to the other keeping the charge in electrostatic equilibrium

Mathematically,

$$\Delta V = \frac{\Delta U}{q_o}$$

29. **Define absolute potential difference.**

Ans. Absolute potential difference or potential at a point is defined as the work done in bringing a unit positive charge from infinity to the point by keeping the charge in electrostatic equilibrium.

Mathematically $V = \frac{1}{4\pi\varepsilon_o}\frac{q}{r}$ (Lhr 2005)

30. **How do shark fish locates their prey precisely?**

Ans. Fish and other sea creatures produces electric fields in a variety of ways. Sharks have special organs, called the ampullae of Lorenzini, that are very sensitive to electric field and can detect potential difference of the order of nano volt and can locate their prey very precisely.

31. **What is Electro Encephalo Graphy (EEG)?**

Ans. Electro Encephalo Graphy is usually applied over the human brian to check its abnormal behaviour by the use of electrical activity. For this electrodes are connected to the selected portion of the head and the corresponding response is seen graphically through the screen of a recording device.

32. What is Electric Cardio Graphy (ECG)?

Ans. An ECG records the "voltage" between points on the human skin generated by the electrical process in the heart. This ECG is made in running position providing information about the heart's performance under stress.

33. What is Electro Retino Graphy (ERG)?

Ans. Electro Retino Graphy is applied on human retina of the eyes to check its abnormal behaviour by the use of electrical activity.

For this electrodes are connected to selected portion of eye and recording device and corresponding response is seen graphically.

34. Is electron volt (eV) a unit of potential difference or energy? Explain?

Ans. Electron volt (eV) is the unit of energy used in nuclear and atomic physics. It can be defined as:

"The amount of energy acquired or lost by an electron as it is traversed by a potential difference of one volt."

1 electron volt = $1eV = 1.6\times10^{-19}$ joules **(D.G.Khan 2006)**

35. Show that $1eV = 1.6\times10^{-19}$ joules

Ans. As during the motion of a charge, it acquired K.E., which is equal to $q\Delta V$.

Thus K.E. = $q\Delta V$

As q = charge on electron = $1.6\times10^{-19}C$

And Δv = 1 volt

Then K.E. = $1.6\times10^{-19}C\times1V$

Or K.E. = $1.6\times10^{-19}J$ $(C\times V = J)$

The amount of energy equal to $1.6\times10^{-19}J$ is called an electron volt. Hence

$1eV = 1.6\times10^{-19}J$

36. How many electrons contribute to 1 coulomb of electrical charge?

Ans. As $Q = ne$

Or $n = \frac{Q}{e}$

Where Q = 1coulomb

$e = 1.6\times10^{-19}$ coulomb

Thus $n = \frac{1}{1.6\times10^{-19}}$

$n = 6.25\times10^{18}$

37. Write any two difference between Gravitational and electrical forces.

Ans. **Gravitational force:**

(i) It is a long ranged force.

(ii) It is an only attractive force.

Electrical force:

(i) It is short ranged force.

(ii) It may be attractive or repulsive.

38. What is capacitor? Also define the capacitance?

Ans. Capacitor is a device which is used to store the charge.

OR

Capacitor is a device which stores the energy into its electric field. And capacitance is the ability of a capacitor to store the charge. **(Lhr 2007)**

39. What is unit of capacitance? Also define it?

Ans. The unit of capacitance of a capacitor is farad (F).

The capacitance of a capacitor is one farad if a charge of one coulomb given to one of the plates of a parallel plate capacitor produces a potential difference of one volt between them. **(Mir Pur 2007)**

40. What are the effect of dielectric between plates of capacitor?

Ans. ⇒ Dielectric decreases the surface charge density effectively.

⇒ Dielectric decreases the electric field strength between the plates.

⇒ Dielectric decreases the electric potential difference between the plates.

⇒ Dielectric increases the capacitance of the parallel plate capacitor.

41. What is a RC circuit? Also define the time constant?

Ans. A circuit consisting of a capacitor and a resistor is called R-C circuit.

Time Constant:

The time required to deposit 0.63 times the equilibrium value of charge is called time constant. **(Lhr 2005)**

42. Show that RC = t

Ans. According to Ohm's law regarding RC series circuit

$V = IR$ ----------(1)

But $I = \frac{q}{t}$

So equation (1) becomes

$V = \frac{q}{t}R$

$R = \frac{Vt}{q}$

$R = \frac{t}{C}$ (As q = CV)

$RC = t$ **(Lhr 2006, Rwp 2006)**

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. A particle having 2e charge falls through a potential difference of 5V. Energy acquired by it is ________
   (a) 2.5 eV (b) 20 eV (c) 0.4 eV (d) 10 eV
2. The increase in capacitance of a capacitor due to presence of dielectric is due to ____ of dielectric.
   (a) Electric polarization (b) Electrification
   (c) Ionization (d) Electrolysis
3. Presence of dielectric always:
   (a) Increases the electrostatic force (b) Decreases the electrostatic force
   (c) Does not effect the electrostatic force (d) Doubles the electrostatic force
4. The word "Xerography" means:
   (a) Writing by left hand (b) Writing by children
   (c) Dry writing (d) Writing by water colours
5. The force experience by unit positive charge placed at a point in an electric field is called:
   (a) Coulomb's force (b) Faraday's force
   (c) Lorentz's force (d) Electric field intensity
6. A dielectric material is placed between plates of parallel plate capacitor. Its capacitance increases due to
   (a) Polarization (b) rectification
   (c) magnification (d) increase electric field
7. In the time constant of RC circuit, how much charge is stored, out of maximum charge q_o
   (a) 0.37 q_o (b) 0.51 q_o (c) 0.63 q_o (d) 0.90 q_o
8. Potential gradient is defined as

   (a) $-\frac{\Delta E}{\Delta V}$ (b) $-\frac{\Delta V}{\Delta E}$ (c) $-\frac{\Delta V}{\Delta r}$ (d) $-\frac{\Delta r}{\Delta V}$
9. Electric field intensity at a point is defined as
   (a) E = q/F (b) E = F/q (c) E = qF (d) E = q/F
10. Charge on an electron was determined by
    (a) Ampere (b) Maxwell (c) Millikan (d) Bohr
11. If a charged body is moved against the electric field, it will gain
    (a) P.E (b) K.E
    (c) mechanical energy (d) electric potential energy
12. In the Xerographic machine, the heart of the machine "drum" is made of
    (a) ceramic (b) semiconductor (c) strong plastic (d) aluminium
13. The SI unit of electric flux is
    (a) Nm^2C^{-1} (b) NmC^{-1} (c) Nm^2C (d) $Nm^{-2}C^{-1}$
14. The SI unit of permittivity ε_o is
    (a) $C^2N^{-1}m^{-2}$ (b) Nm^2C^{-2} (c) NmC^{-2} (d) NmC^{-1}
15. The SI unit of Coulomb's Constant is
    (a) Nm^2C^2 (b) $Nm^{-2}C^2$ (c) Nm^2C^{-2} (d) $Nm^{-2}C^{-2}$
16. The force between two point charges separated by air is 4 N. When separated by a medium of relative permittivity 2, the force between them becomes
    (a) ½ N (b) 2 N (c) 4 N (d) 8 N
17. farad is defined as
    (a) C/V (b) A/V (c) C/J (d) J/C
18. Photocopier and inkjet printer are the application of
    (a) electronics (b) electricity (c) magnetism (d) electrostatics
19. When area is held perpendicular to the field lines, then the magnitude of electric flux is
    (a) maximum (b) minimum (c) either max or min (d) none of these
20. A unit of electric charge is
    (a) volt (b) henry (c) coulomb (d) Weber
21. The expression for energy stored in a capacitor is given as
    (a) $E = CV^2$ (b) $E = \frac{1}{2}CV^2$ (c) $E = \frac{1}{2}C^2V$ (d) $E = \frac{1}{2}(CV)^2$
22. The value of relative permittivity for all the dielectrics other than air or vacuum is always
    (a) less than unity (b) greater than unity
    (c) equal to unity (d) zero

Answers Key:

1.	(d) 10 eV	12.	(d) aluminium
2.	(a) Electric polarization	13.	(a) Nm^2C^{-1}
3.	(b) Decreases the electrostatic force	14.	(a) $C^2N^{-1}m^{-2}$
4.	(c) Dry writing	15.	(c) Nm^2C^{-2}
5.	(d) Electric field intensity	16.	(b) 2 N
6.	(a) Polarization	17.	(a) C/V
7.	(c) 0.63 q_o	18.	(d) electrostatics
8.	(c) $-\frac{\Delta V}{\Delta r}$	19.	(a) maximum
9.	(b) E = F/q	20.	(c) coulomb
10.	(c) Millikan	21.	(b) $E = \frac{1}{2}CV^2$
11.	(d) electric potential energy	22.	(d) zero

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Chapter 13 CURRENT ELECTRICITY

Topic Wise MCQ's

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer

Electric Current, Sources of Current, Effects of Current

1. Which one of the following quantities is not a vector?
   (a) electric intensity (b) electric force
   (c) current (d) potential gradient
2. The $C\,s^{-1}$ unit of is
   (a) electric intensity (b) capacitance
   (c) electric potential (d) current
3. One coulomb per second is equal to:
   (a) one volt (b) one ampere
   (c) one watt (d) one ohm
4. An electric current in a wire involves the movement of
   (a) electrons (b) protons
   (c) ions (d) molecules
5. A wire has a current of 5A in it. How much charge passes a point in the wire in 2 minutes?
   (a) 50 C (b) 100 C
   (c) 150 C (d) 600 C
6. When electric current flows through a wire, it increases
   (a) K.E. of the atoms (b) P.E. of the protons
   (c) P.E. of the electrons (d) both a and c
7. The current through a metallic conductor is due to motion of

Answers Key:

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6. When electric current flows through a wire, it increases
   (a) K.E. of the atoms (b) P.E. of the protons
   (c) P.E. of the electrons (d) both a and c
7. The current through a metallic conductor is due to motion of

(a) protons (b) neutrons
(c) electrons (d) ions

8. In electrolyte, the charge carries are
(a) positive ions only (b) negative ions only
(c) both positive and negative ions
(d) electrons and protons

9. In gases, the charge carriers are
(a) electrons (b) ions
(c) electrons and ions (d) neither electrons nor ions

10. The electronic current is due to flow of
(a) negative charge (b) positive charge
(c) both (a) and (b) (d) nuclei of atoms

11. Current is measured by its
(a) external effects (b) internal effects
(c) side effects (d) none of these

12. When a current is flowing through a wire, an electric field must exist:
(a) in the wire (b) around the wire
(c) at the ends of a wire (d) none of these

13. The potential difference between the head and tail of an electric eel can be up to
(a) 6V (b) 600V
(c) 600mV (d) 600kV

14. The net acceleration produced in current carrying wire is
(a) maximum (b) minimum
(c) zero (d) negative

15. The drift velocity of electrons increases with increase in
(a) temperature of wire
(b) length of wire
(c) area of cross-section of wire
(d) both a and c

16. The drift velocity of electrons in a conductor is of the order of
(a) $10^3\ ms^{-1}$ (b) $10^{-3}\ ms^{-1}$
(c) $10^{-19}\ ms^{-1}$ (d) $10^8\ ms^{-1}$

17. The velocity of the free electrons at room temperature due to their thermal motion is

(a) several meters per second
(b) several hundred kilometers per second
(c) several thousand kilometers per second
(d) none of these

18. The uniform velocity gained by the electrons in a conductor placed in an electric field is called
(a) critical velocity (b) drift velocity
(c) maximum velocity (d) all of these

19. A current carrying metallic wire produces around itself
(a) electric field (b) magnetic field
(c) both electric & magnetic fields (d) none of these

20. Solar cells converts sun light directly into:
(a) mechanical energy (b) chemical energy
(c) electrical energy (d) heat energy

21. Thermo-couple converts heat energy into:
(a) atomic energy (b) chemical energy
(c) tidal energy (d) electrical energy

22. Electric generator converts mechanical energy into:
(a) heat energy (b) electrical energy
(c) solar energy (d) nuclear energy

23. The presence of electric current is detected by its
(a) heating effect (b) magnetic effect
(c) chemical effect (d) all of these

24. The device which converts heat into electrical energy is:
(a) solar cell (b) battery
(c) thermocouple (d) cell

25. Heat produced by current I in a wire of resistance R during time t is:
(a) $H = IR^2t$ (b) $H = I^2Rt$
(c) $H = IRt^2$ (d) $H = IRt$

26. The heating effect of current is used in:
(a) toaster (b) electric iron
(c) electric heater (d) all of these

27. If the current passing through a conductor is reduced to half, then the heat produced becomes [Hint $H = I^2Rt$]
(a) 2times (b) remains same
(c) ¼ times (d) none of these

28. All the machines like motors use __________ effect of current
(a) heating (b) magnetic
(c) chemical (d) both a & b

29. The acceleration of the electrons passing through a wire carrying a steady current is (m = mass of electron)
(a) qE/m (b) mq/E
(c) F/m (d) zero

30. The process of coating a thin layer of some expensive metal on an article of some cheap metal is called
(a) electrolysis (b) electromagnetism
(c) electroplating (d) overlapping

OHM'S Law, Resistivity and Its Dependence Upon Temperature

31. Ohm's law can be applied to
(a) A.C (b) D.C.
(c) both a and b (d) none of these

32. Which one of the following expressions is not correct?
(a) $R = \rho\frac{L}{A}$ (b) $R = \frac{V}{I}$
(c) I = R/V (d) none of those

33. According to ohm's law current passing through a conductor is directly proportional to applied potential difference provided ______ of conductor does not change
(a) temperature (b) density
(c) pressure (d) all of these

34. Slope of VI- graph is numerically equal to
(a) capacitor (b) $\frac{1}{\text{resistance}}$
(c) resistance (d) none

35. volt/ampere is the unit of
(a) current (b) resistance

(c) capacitance (d) electric intensity

36. Ohm is defined as
(a) VC^{-1} (b) CV^{-1}
(c) AV^{-1} (d) VA^{-1}

37. Two bulbs of 100W and 200W are operated on same voltage. The ratio of their filament resistances is [Hint $P=V^2/R$]
(a) 1 (b) 4
(c) 2 (d) 3

38. The property of a substance which opposes the flow of current is called
(a) conductivity (b) Resistivity
(c) resistance (d) Inductance

39. Which one of the following does not obey Ohm's law?
(a) filament bulb (b) copper
(c) carbon (d) all of these

40. Semiconductor is the example of __________ substance
(a) ohmic (b) non-ohmic
(c) insulator (d) none of these

41. The value of the resistance depends upon
(a) nature of the conductor
(b) dimensions of the conductor
(c) physical state of the conductor
(d) all of these

42. The resistance of a wire increases with increase in
(a) diameter (b) length
(c) temperature (d) both b and c

43. What is the current through a 5×10^5 ohm resistor having a potential difference of 5×10^2 volts?
(a) 10^{-3} A (b) 10^3 A
(c) 10^{-7} A (d) 10^7 A

44. For ohmic devices, the graph between V and I is
(a) a straight line (b) hyperbola
(c) parabola (d) a curved line

45. The current through a resistor of 100 Ω when connected across a source of 220 V is:

(a) 200 A (b) 22000 A
(c) 0.45 A (d) 2.2 A

46. If the resistances R_1 and R_2 a are connected in series, then the equivalent resistance is

(a) $R_e = \dfrac{R_1 + R_2}{R_1 R_2}$ (b) $R_e = \dfrac{R_1 R_2}{R_1 + R_2}$
(c) $\dfrac{1}{R_e} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$ (d) $R_e = R_1 + R_2$

47. If the resistances R_1 and R_2 are connected in parallel, then the equivalent resistance is:

(a) $R_e = R_1 + R_2$ (b) $R_e = R_1 \times R_2$
(c) $R_e = \dfrac{R_1 R_2}{R_1 + R_2}$ (d) $R_e = \dfrac{R_1 + R_2}{R_1 R_2}$

48. The potential difference across each resistance in parallel combination is
(a) same (b) different
(c) infinite (d) zero

49. The current through each resistance in series combination is
(a) same (b) different
(c) zero (d) none of these

50. If the resistances of 2 ohm and 4 ohm are connected in series, the equivalent resistance will be
(a) 2 ohm (b) 6 ohm
(c) 1.33 ohm (d) $\frac{3}{4}$ ohm

51. If the resistance of 2, 3 and 6 ohms are connected in parallel, their equivalent resistance is:
(a) 1.0 ohms (b) 3.0 ohms
(c) 5.0 ohms (d) 11.0 ohms

52. Three resistance 1Ω, 2Ω and 3Ω are connected in series by a battery of 6 volts then the current flowing through each resistor will be:
(a) 1.5 A (b) 0.5
(c) 1.0 A (d) 2.0 A

53. The resistance of a wire is directly proportional to its
(a) diameter (b) area of cross section

(c) length (d) both a and b

54. The resistance of a wire is inversely proportional to its
(a) diameter (b) area of cross section
(c) length (d) both a and b

55. When the temperature of a conductor increases, its
(a) resistance increases (b) resistivity decreases
(c) resistivity increases (d) both a & c

56. The resistance of a meter cube of the substance is called
(a) conductivity (b) permittivity
(c) resistivity (d) permeability

57. The reciprocal of the resistance is called
(a) reactance (b) conductance
(c) impedance (d) capacitance

58. The unit of conductance is
(a) mho (b) siemen
(c) Ω^{-1} (d) All of these

59. The SI unit of resistivity is
(a) Ω^{-1}m (b) ohm-m
(c) ohm-m^{-1} (d) ohm-m^{-2}

60. The resistivity of a material depends upon
(a) temperature (b) nature of material
(c) both a and b (d) resistance

61. A wire of uniform area of cross-section A length L and resistance R is cut into two equal parts. The resistivity of each part is
(a) doubled (b) same
(c) halved (d) one fourth

62. The resistance of a conductor does not depend on its
(a) length (b) cross sectional area
(c) diameter (d) none of these

63. The reciprocal of the resistivity of a material is called
(a) conductivity (b) permittivity
(c) conductance (d) permeability

64. If the diameter of a wire is doubled, then its resistance will become

(a) 2times (b) ½ times
(c) 4times (d) ¼ times

65. When the temperature of a conductor is raised, its
(a) resistance increases (b) conductance decreases
(c) resistivity decreases (d) both a and b

66. The resistance of a conductor at absolute zero (0 K) is
(a) zero (b) infinite
(c) positive (d) negative

67. The temperature co-efficient of resistance of a material is given by
(a) $\alpha = \frac{R_o - R_t}{R_o t}$ (b) $\alpha = \frac{R_t - R_o}{R_o t}$
(c) $\alpha = \frac{\rho_o - \rho_t}{\rho_o t}$ (d) $\alpha = \frac{\rho_t - \rho_o}{\rho_o t}$

68. The SI unit of temperature co-efficient of resistance or resistivity of a material is
(a) ohm-m (b) K
(c) K^{-1} (d) ohm-K

69. The substances whose resistance decreases with increase in temperature have
(a) negative temperature coefficient
(b) positive temperature coefficient
(c) zero temperature coefficient
(d) infinite temperature coefficient

70. The fractional change in resistance per Kelvin is known as ________ of resistance
(a) temperature coefficient (b) volume coefficient
(c) resistance coefficient (d) all of these

71. A platinum wire has resistance of 10Ω at 0°C and 20Ω at 273°C. Value of its temperature coefficient is
(a) 273 K^{-1} (b) 1/273 K^{-1}
(c) 2.73 K^{-1} (d) none of these

72. The substance having negative temperature coefficient is
(a) carbon (b) germanium
(c) silicon (d) all of these

Colour Code for Carbon Resistances, Rheostat, Thermistor

73. If the resistance value of a carbon resistor is 5000Ω then the colour of first band is
(a) blue (b) red
(c) green (d) yellow

74. The colour code of carbon resistor usually consists of ________ bands
(a) 3 (b) 4
(c) 5 (d) 6

75. In carbon resistors, the first band indicates the
(a) zero digit (b) first digit
(c) resistivity (d) tolerance

76. In carbon resistors, the ________ band gives the number of zeros
(a) first (b) second
(c) third (d) fourth

77. The possible variation from the marked value of a carbon resistor is called
(a) inductance (b) tolerance
(c) capacitance (d) reactance

78. If the colour code on the carbon resistor from left to right are white violet and red, then the resistance will be
(a) 9700Ω (b) 970Ω
(c) 97Ω (d) none of these

79. A gold band on carbon resistor shows a tolerance of
(a) ±5% (b) ±10%
(c) ±15% (d) ±20%

80. A silver band on carbon resistor shows a tolerance of:
(a) ±5% (b) ±10%
(c) ±15% (d) ±20%

81. If there is no fourth band, it means tolerance is
(a) ±0% (b) ±5%
(c) ±10% (d) ±20%

82. According to colour code, the numerical value of the blue colour on carbon resistor
(a) 6 (b) 7
(c) 8 (d) 9

83. A 1000Ω resistor with a tolerance of ±10% will have an actual resistance anywhere between
(a) 990Ω and 1010Ω (b) 950Ω and 1050Ω
(c) 90Ω and 110Ω (d) 900Ω and 1100Ω

84. The wire wound over an insulating cylinder of a rheostat is made of:
(a) silver (b) gold
(c) copper (d) manganin

85. A rheostat can be used as
(a) variable resistor (b) potential divider
(c) thermistor (d) both (a) and (b)

86. When rheostat is used as variable resistor in a circuit, ________ terminals are inserted in the circuit.
(a) two fixed (b) two fixed and the sliding
(c) one fixed and the sliding (d) only sliding

87. A thermistor is a heat sensitive
(a) resistor (b) capacitor
(c) inductor (d) diode

88. Thermistors are of _____ types
(a) 2 (b) 3
(c) 4 (d) none of these

89. The thermistors convert change of temperature into
(a) heat energy (b) light energy
(c) electrical voltage (d) solar energy

90. The thermistors are in the form of
(a) beads (b) rods
(c) washers (d) all of these

91. Thermistors with high negative temperature coefficient are very accurate for measuring low temperature near
(a) -10°C (b) 10 K
(c) -10°F (d) 10°C

92. A zero ohm resistor is has _____ colour band
(a) black and gold (b) single black
(c) single brown (d) none of these

Electrical Power and Power Dissipation in Resistors, Electromotive Force (EMF) And Potential Difference (V)

93. Work done on a charge 2μC when it moves through a potential difference of 100V volts is
(a) 50J (b) 200J
(c) 2×10^{-4}J (d) 0.2J

94. Energy dissipated per second as heat in a conductor of resistance R due to electric current I is given by
(a) IR (b) I^2R
(c) I^2Rt (d) V^2Rt

95. When the current drawn from a battery is increased,
(a) terminal potential difference is increased
(b) potential drop across internal resistance is decreased
(c) emf of battery is decreased
(d) terminal potential difference is decreased

96. Power dissipated in resistor can be calculated by the expression:
(a) $P = VI$ (b) $P = I^2R$
(c) $P = \frac{V^2}{R}$ (d) all of these

97. The unit of power is
(a) volt (b) joule
(c) ampere (d) watt

98. An electric fan draws a current of 5 ampere at 220 volts, its power is:
(a) 360 W (b) 1100 W
(c) 440 W (d) 2200 W

99. Heat generated by a 40 watts bulb in one hour is:
(a) 4800 J (b) 14400 J
(c) 144000 J (d) 1440 J

100. A 100 watt bulb is operated by 200 volt, the current flowing through the bulb is:
(a) 1 ampere (b) 0.5 ampere
(c) 2 ampere (d) 2.5 ampere

101. The resistance of a 60 watt bulb in a 120 volt line is:
(a) 20 ohms (b) 0.5 ohms

(c) 240 ohms (d) 2.0 ohms

102. 1 KWh= ________
(a) 3.6×10^4 J (b) 3.6×10^5 J
(c) 3.6×10^6 J (d) 3.6×10^7 J

103. Which one of the following bulbs has the least resistance operated at 220V?
(a) 100 W (b) 200 W
(c) 500 W (d) 100 W

104. The unit of electrical energy is:
(a) watt (b) kilowatt
(c) kilowatt-hour (d) volt

105. The energy supplied to unit charge by the cell is called
(a) current (b) P.E.
(c) K.E. (d) emf(E)

106. The emf of a source can be calculated by:
(a) $E = \frac{\Delta q}{\Delta W}$ (b) $E = \frac{\Delta W}{\Delta q}$
(c) $E = \Delta W \Delta q$ (d) $E = \Delta W + \Delta q$

107. The SI unit of electromotive force (emf) is:
(a) newton (b) ampere
(c) volt (d) joule

108. 1 joule/coulomb is equal to
(a) volt (b) ampere
(c) farad (d) ohm

109. Electromotive force is closely related to
(a) electric field intensity (b) magnetic flux density
(c) potential difference (d) inductance

110. Unit of emf is same as that of
(a) force (b) energy
(c) potential difference (d) both b and c

111. The relation between terminal potential difference V_t of a battery of internal resistance r and emf E is
(a) $V_t = E + Ir$ (b) $V_t = E - Ir$

(c) $V_t = \frac{E}{Ir}$ (d) $V_t = E - \frac{I}{r}$

112. Terminal potential difference of a battery is equal to its emf when its internal resistance is:
(a) Zero (b) equal to load resistance
(c) very high (d) very low

113. When current drawn from battery is increased
(a) $V_t = E$ (b) $V_t > E$
(c) $V_t = 0$ (d) none of these

114. Terminal potential difference of a battery is greater than its emf when:
(a) the internal resistance of the battery is infinite
(b) the internal resistance of the battery is zero
(c) the battery is being charged
(d) the battery is being discharged

115. Whenever current is drawn from a cell, its terminal potential difference and emf become
(a) different (b) same
(c) zero (d) maximum

116. For an open circuit
(a) $V_t = 0$ (b) $E > V_t$
(c) $E = 0$ (d) $E = V_t + Ir$

117. For an open circuit, the current flowing through the circuit will be
(a) infinite (b) finite
(c) maximum (d) zero

118. When no current is drawn through the battery then emf is
(a) zero (b) not zero
(c) equal to V_t (d) none of these

119. When no current is drawn through the battery then potential difference across the conductor is
(a) zero (b) maximum
(c) infinite (d) none of these

120. Internal resistance is the resistance offered by
(a) source of emf (b) conductor

(c) load resistance (d) circuit

121. The terminal potential difference is always:
(a) equal to emf of the battery (b) less than emf of battery
(c) greater than emf of battery (d) zero

122. The maximum power (P_{out}) is delivered by cell to a load resistance R, when
(a) R = 0 (b) R= ∞
(c) R= 2r (d) R = r

123. A cell has emf E and internal resistance r, then the maximum available power from the cell is
(a) $\frac{E^2}{4r}$ (b) $\frac{E^2}{4r^2}$
(c) $\frac{E}{4r}$ (d) $\frac{E}{4r^2}$

124. The electromotive force of a battery or cell is the voltage between its terminals when
(a) the circuit is open
(b) the circuit is closed
(c) its internal resistance is minimum
(d) its internal resistance is maximum

KIRCHHOFF'S RULES, WHEATSTONE BRIDGE, POTENTIOMETER

125. Kirchhoff's first rule can applied to a point if there is no _____ of charge at that point
(a) source (b) sink
(c) both a and b (d) flow

126. Sum of all the currents meeting at a point in the circuit is zero (i.e., $\Sigma I = 0$), is the statement of
(a) Ohm's law (b) Coulomb's law
(c) Ampere's law (d) Kirchhoff's first rule

127. According to Kirchhoff's 2nd rule, algebraic sum of all potential drops is equal to
(a) negative (b) sum of emfs of batteries
(c) zero (d) none of these

128. A current flowing away from a point is taken as:
(a) positive (b) negative
(c) zero (d) neutral

129. The sum of all the currents flowing towards a point is equal to the sum of the currents flowing away from the point is a statement of
(a) Kirchhoff's first rule (b) Kirchhoff's second rule
(c) Kirchhoff's point rule (d) both a and c

130. Kirchhoff's first rule is the manifestation of the law of conservation of:
(a) mass (b) energy
(c) momentum (d) charge

131. Kirchhoff's first rule is also known as
(a) Kirchhoff's voltage rule (b) Kirchhoff's point rule
(c) Kirchhoff's mass rule (d) Kirchhoff's energy rule

132. The algebraic sum of potential changes for a complete circuit is zero, is a statement of:
(a) Kirchhoff's first rule (b) Kirchhoff's second rule
(c) Faraday's law (d) Gauss's law

133. Kirchhoff's second rule is according to law of conservation of
(a) mass (b) energy
(c) momentum (d) charge

134. While applying KVL if a source of emf is traversed from negative to positive terminal, the potential change is
(a) positive (b) negative
(c) zero (d) constant

135. While applying KVL if a source of emf is traversed from positive to negative terminal, the potential change is
(a) positive (b) negative
(c) zero (d) constant

136. While applying KVL if a resistor is traversed in the direction of current, the change in potential is
(a) Positive (b) negative
(c) Zero (d) constant

137. If a resistor is traversed opposite to the direction of current, the change in potential is
(a) Positive (b) negative
(c) Zero (d) constant

138. Wheatstone bridge is used to determine
(a) current (b) emf
(c) Charge (d) resistance

139. Wheatstone bridge is an arrangement consisting of _______ resistance
(a) two (b) three
(c) four (d) five

140. The condition for the Wheatstone bridge to be balanced is given by
(a) $R_1R_2=R_3R_4$ (b) $R_2R_3=R_1R_4$
(c) $R_2R_3 \geq R_1R_4$ (d) $\frac{R_1}{R_2}=\frac{R_4}{R_3}$

141. When the Wheatstone bridge is balanced then
(a) maximum current flows through the galvanometer
(b) minimum current flows through the galvanometer
(c) potential difference across galvanometer is maximum
(d) potential difference across galvanometer is zero

142. If the resistance in the three successive arms of balanced Wheatstone bridge are 2, 1 and 36 ohms respectively, the resistance in the fourth arm will be
(a) 18Ω (b) 39Ω
(c) 72Ω (d) 50Ω

143. Three arms of a balanced Wheatstone bridge are of 25 ohms resistance each. What is the resistance of the fourth arm?
(a) 15Ω (b) 25Ω
(c) 50Ω (d) 75Ω

144. Slide wire bridge is a practical form of
(a) galvanometer (b) voltmeter
(c) Wheatstone bridge (d) potentiometer

145. An instrument which can measure potential without drawing any current is called
(a) voltmeter (b) galvanometer
(c) potentiometer (d) ammeter

146. A circuit which gives continuously varying potential is
(a) potentiometer (b) voltmeter
(c) rheostat (d) both a and c

147. emf of a cell (by potentiometer) can be determined by the following relation
(a) $E_x=\frac{L}{\ell}E$ (b) $E_x=\frac{\ell}{E}L$

(c) $E_x=\frac{\ell}{L}E$ (d) $\frac{E}{L}\ell$

148. Potentiometer is used to
(a) compare emf of two cells
(b) measure internal resistance of a cell
(c) measure potential difference
(d) all of these

149. Potentiometer can be used as
(a) ammeter (b) voltmeter
(c) potential divider (d) both b and c

150. Potentiometer practically draw:
(a) very large amount of current
(b) finite amount of current
(c) very small amount of current
(d) no current

151. Working principle of potentiometer is that potential difference across any length the resistance of wire uniform thickness is
(a) directly proportional to the length of wire
(b) inversely proportional to the length of wire
(c) constant at all length of wire
(d) absolutely zero at all lengths of wire

152. Which one is used to determine the internal resistance of a cell?
(a) ammeter (b) voltmeter
(c) galvanometer (d) potentiometer

Answer Key's

1.	(c) current	2.	(d) current
3.	(b) one ampere	4.	(a) electrons
5.	(d) 600 C	6.	(a) K.E. of the atoms
7.	(c) electrons	8.	(c) both positive and negative ions
9.	(c) electrons and ions	10.	(a) negative charge
11.	(a) external effects	12.	(a) in the wire
13.	(b) 600V	14.	(c) zero
15.	(d) both a and c	16.	(b) 10^{-3} ms^{1}
17.	(b) several hundred kilometers per second	18.	(b) drift velocity
19.	(b) magnetic field	20.	(c) electrical energy
21.	(d) electrical energy	22.	(b) electrical energy
23.	(d) all of these	24.	(c) thermocouple
25.	(b) $H = I^2Rt$	26.	(d) all of these
27.	(c) ¼ times	28.	(b) magnetic
29.	(d) zero	30.	(c) electroplating
31.	(c) both a and b	32.	(c) $I = R/V$
33.	(d) all of these	34.	(b) $\frac{1}{resistance}$
35.	(b) resistance	36.	(d) VA^{-1}
37.	(c) 2	38.	(c) resistance
39.	(a) filament bulb	40.	(b) non-ohmic
41.	(d) all of these	42.	(d) both b and c
43.	(a) 10^{-3} A	44.	(a) a straight line
45.	(d) 2.2 A	46.	(d) $R_e = R_1 + R_2$
47.	(c) $R_e = \frac{R_1R_2}{R_1+R_2}$	48.	(a) same
49.	(a) same	50.	(b) 6 ohm

51.	(a) 1.0 ohms	52.	(c) 1.0 A
53.	(c) length	54.	(d) both a and b
55.	(d) both a and c	56.	(c) resistivity
57.	(b) conductance	58.	(d) all of these
59.	(b) ohm-m	60.	(c) both a and b
61.	(b) same	62.	(d) none of these
63.	(a) conductivity	64.	(d) ¼ times
65.	(d) both a and b	66.	(a) zero
67.	(b) $\alpha = \frac{R_t - R_o}{R_o t}$	68.	(c) K^{-1}
69.	(a) negative temperature coefficient	70.	(a) temperature coefficient
71.	(b) $1/273\ K^{-1}$	72.	(d) all of these
73.	(c) green	74.	(b) 4
75.	(b) first digit	76.	(c) third
77.	(b) tolerance	78.	(a) 9700Ω
79.	(a) ±5%	80.	(b) ±10%
81.	(d) ±20%	82.	(b) 7
83.	(d) 900Ω and 1100Ω	84.	(d) manganin
85.	(d) both a and b	86.	(c) one fixed and the sliding
87.	(a) resistor	88.	(a) 2
89.	(c) electrical voltage	90.	(d) all of these
91.	(b) 10 K	92.	(b) single black
93.	(c) 2×10^{-4} J	94.	(b) I^2R
95.	(d) terminal potential difference is decreased	96.	(d) all of these
97.	(d) watt	98.	(b)1100 W
99.	(c) 144000 J	100.	(b) 0.5 ampere
101.	(c) 240 ohms	102.	(c) 3.6×10^{6} J
103.	(c) 500 W	104.	(c) kilowatt-hour
105.	(d) emf(E)	106.	(b) $E = \frac{\Delta W}{\Delta q}$

107.	(c) volt	108.	(a) volt
109.	(c) potential difference	110.	(c) potential difference
111.	(b) $V_t = E - Ir$	112.	(a) zero
113.	(d) none of these	114.	(c) the battery is being charged
115.	(a) different	116.	(a) $V_t = 0$
117.	(d) zero	118.	(b) not zero
119.	(a) zero	120.	(a) source of emf
121.	(b) less than emf of battery	122.	(d) R = r
123.	(a) $\frac{E^2}{4r}$	124.	(a) the circuit is open
125.	(c) both a and b	126.	(d) Kirchhoff's first rule
127.	(b) negative	128.	(b) both a and b
129.	(d) both a and c	130.	(d) charge
131.	(b) kirchhoff's point rule	132.	(b) kirchhoff's second rule
133.	(b) energy	134.	(a) positive
135.	(b) negative	136.	(b) negative
137.	(a) positive	138.	(d) resistance
139.	(c) four	140.	(b) $R_2R_3 = R_1R_4$
141.	(d) potential difference across galvanometer is zero	142.	(a) 18Ω
143.	(b) 25Ω	144.	(c) Wheatstone bridge
145.	(c) potentiometer	146.	(a) potentiometer
147.	(c) $E_x = \frac{\ell}{L}E$	148.	(d) all of these
149.	(d) both b and c	150.	(d) no current
151.	(a) directly proportional to the length of wire	152.	(d) potentiometer

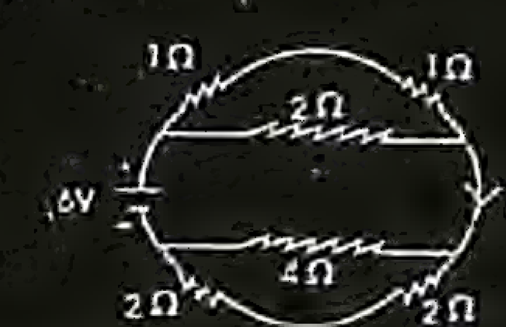
Brain Teasing MCQ's (with Hints)

◇ Four possible answers to each statement are given below. Tick (✓) the correct answer

1. The resistance of a wire is R. It is cut into four equal parts and bundled together in parallel. The equivalent resistance will be
   (a) 4R (b) $\frac{R}{4}$
   (c) $\frac{R}{16}$ (d) R

2. A wire of resistance R is stretched four times its length uniformly. Its new resistance will be
   (a) 16R (b) 4R
   (c) $\frac{R}{4}$ (d) $\frac{R}{16}$

3. A car battery has emf 12V and internal resistance $5 \times 10^{-2}\Omega$. If it draw 60 A current, the terminal voltage of battery will be
   (a) 3V (b) 5V
   (c) 9V (d) 12V



4. In fig the current I is
   (a) 1A (b) 2A
   (c) 1.5A (d) 3A

5. Of the two bulbs in a house, one glow brighter than the other. Which of the following has larger resistance
   (a) The brighter bulb (b) The dim bulb
   (c) Both have same resistance (d) Brightness does not depend on resistance

6. The maximum out put power gives the value
   (a) $\frac{E^2}{4r}$ (b) $\frac{E}{4r}$
   (c) $\frac{4E}{r}$ (d) $\frac{4r}{E}$

7. Two wires of same metal have the same length but their area are in the ratio 3:1. The two wires are connected in series. The resistance of thicker wire is 10Ω. What is total resitance of combination?

(a) 20Ω (b) $\frac{40}{3}\Omega$

(c) 30Ω (d) 40Ω

8. How many electrons constitute current of one ampere?

(a) 6.25×10^{18} (b) 6.25×10^{-18}

(c) 1.6×10^{19} (d) 1.6×10^{-19}

9. The resistance of a wire is 1Ω. Which of the following is new resistance if length of wire is doubled?

(a) 2Ω (b) 4Ω

(c) $\frac{1}{2}\Omega$ (d) $\frac{1}{4}\Omega$

10. A carbon resistance reads red-red-black. What is its resistance?

(a) 2.2Ω (b) 20Ω

(c) 22Ω (d) 220Ω

11. Kirchhoff's current rule obeys the conservation of

(a) Momentum (b) Energy

(c) emf (d) Charge

12. The reciprocal of resistance is called

(a) Conductivity (b) Conductance

(c) Capacitance (d) Reactance

13. The amount of heat produced in a resistor when a current is passed through it can be found using

(a) Joule's law (b) Kirchhoff's rule

(c) Faraday law (d) Lenz's law

14. A uniform resistance wire of length L and diameter D has a resistance R. Another wire of same material has length 4L and diameter 2D, its resistance will be

(a) 2R (b) R

(c) $\frac{R}{2}$ (d) $\frac{R}{4}$

15. In which from is energy in a battery stored?

(a) Mechanical (b) Electrical

(c) Chemical (d) Kinetic

16. Mass of substance librated during electrolysis in a given time depends upon

(a) Resistance (b) Electric power

(c) Working temperature (d) Electric current

17. An electric bulb of 100 watt is connected to supply of 220V. Which of the following is the resistance of filament?

(a) 100Ω (b) 484Ω

(c) 2200Ω (d) 22000Ω

18. Which of the following is commercial unit of electricity?

(a) Watt (b) Kilowatt

(c) Kilowatt hour (d) Horse power

19. A 100W and 25W bulb are connected in series with a 220 V supply. Which of the following is the net power consumed?

(a) 20W (b) 16W

(c) 10W (d) 4W

20. A copper wire is connected across a battery. The drift velocity of electron is V. If another wire of same length and double the radius is connected across the same battery, The drift velocity will be

(a) 4V (b) 2V

(c) V (d) $\frac{V}{2}$

21. The resistivity of a wire depends on its

(a) Length (b) Area

(c) Shape (d) Material

22. Sensitivity of a potentiometer can be increased by

(a) Increasing emf of cell (b) Increasing the length of wire

(c) Decreasing the length of wire (d) None of these

23. E is emf of a battery. What will be the potential drop across terminals an external resistance R = r (internal resistance) is connected across it

(a) $\frac{E}{2}$ (b) $\frac{E}{4}$

(c) 2E (d) 4E

24. You are given three bulbs of 25W, 40W and 60W. Which of them has lowest resistance?

(a) 25 W bulb (b) 40 W bulb
(c) 60 W bulb (d) All have equal resistance

25. The resistance of a conductor is 5Ω at 50C° and 6Ω at 100C°. Which of the following is its resistance at 0C°
(a) 10Ω (b) 2Ω
(c) 3Ω (d) 4Ω

26. A main line has a power of 11kW. Which of the following is the maximum number of 100 watt bulbs connected for full glow?
(a) 100 in series (b) 100 in parallel
(c) 110 in parallel (d) 110 in series

Answer with Hints

No.	Correct Option	Answers	Hint
1	c	$\frac{R}{16}$	When cut in to four equal parts then resistant of each part is $\frac{R}{4}$ when four parts are bundled together in parallel then $\frac{1}{R_{eq}}=\frac{1}{R/4}+\frac{1}{R/4}+\frac{1}{R/4}+\frac{1}{R/4}$ $\frac{1}{R_{eq}}=\frac{16}{R}$ $R_{eq}=\frac{R}{16}$
2	a	16R	New length = $\ell' = 4\ell$ New area $A'=\frac{A}{4}$ Initial resistance $R=\rho\frac{L}{A}$

			New resistance $R'=\rho\frac{L'}{A'}$ $R'=\rho\frac{(4\ell)}{\frac{A}{2}}$ $R'=16\left(\ell\frac{L}{A}\right)$ $R'=16R$
3	c	9V	$V_t=\in-Ir$
4	b	2A	
5	b	The dim bulb	
6	a	$\frac{E^2}{4r}$	
7	d	40Ω	
8	a	6.25×10^{18}	
9	a	2Ω	$R\ \alpha\ \ell$
10	c	22Ω	
11	d	Charge	
12	b	conductance	
13	a	Joule's law	$H=I^2Rt$
14	b	R	
15	c	chemical	
16	d	electric current	
17	b	484Ω	$R=\frac{V^2}{P}$ $R=\frac{(220)^2}{100}$ $R=484\Omega$

18	c	Kwh	
19	a	20w	$\frac{1}{P}=\frac{1}{P_1}+\frac{1}{P_2}$ $P=\frac{P_1P_2}{P_1+P_2}$ $P=\frac{100\times25}{100+25}$ $P=\frac{2500}{125}$ $P=20W$
20	c	V	$Vd=\frac{I}{nAe}$ Area increases four time and current also increases four times therefore drift velocity remain same
21	d	material	
22	b	increasing length of wire	
23	a	$\frac{E}{2}$	$E=IR+Ir$ of $r=R$ $E=IR+IR$ $E=2IR$ $E=2V$ $V=\frac{E}{2}$
24	c	60w bulb	$P=\frac{V^2}{R}$ & $R=\frac{V^2}{P}$
25	d	4Ω	
26	c	110 connected in parallel	$\frac{11000}{100}=110$

Additional Short Questions

1. **Often, you might have noticed birds sitting safely on high tension wires. Why are they not electrocuted even when sitting on a part of wire where insulation has worn off?**

Ans. For electrocution, The current should pass through the body. The current passes only if there is a potential difference between different parts of the body. When bird is sitting on high tension wire without insulation, the potential difference between its two feet is zero as both feet are on the same potential.

$$\Delta V=0 \qquad \Rightarrow \qquad I=\frac{\Delta V}{R}=\frac{0}{R}=0$$

No current flows through the body of the bird and it is not electrocuted.

2. **Why it is dangerous to touch a live wire while standing on earth bare footed?**

Ans. The potential of earth is considered as zero. A person standing on the earth barefooted is also at zero potential. If he touches a live wire at high potential, the current will flow through his body due to potential difference, hence it is dangerous to touch a live wire while standing on earth bare footed.

3. **What is electroplating?**

Ans. The process of coating (depositing) a thin layer of some expensive metal (gold, silver) on an article of some cheaper metal is called electroplating. It is possible only due to chemical effect of current.

7. **Which is preferred for measuring emf of a cell, a voltmeter or a potentiometer?**

Ans. Potentiometer. Because, at balance point, the potentiometer does not draw any current from the source of emf. But a voltmeter always draws small current and hence it gives a reading less than emf of the cell.

11. **What is difference between drift velocity and Thermal velocity?**

Ans.

Drift velocity	Thermal velocity
(i) The average velocity acquired by free electron in a conductor opposite to electric field in called drift velocity.	(i) Like gas molecules the conduction electrons move in all directions with all possible velocities, called thermal velocity.
(ii) Drift velocity is of the order of	(ii) Thermal velocity is several

	few mm/sec		hundred km/sec
(iii)	Drift velocity decrease with rise in temperature.	(iii)	Thermal velocity increase with rise in temperature.
(iv)	Drift velocity is zero when electric field is zero.	(iv)	Electron move with thermal velocity in the absence of electric field as well as in the presence of electric field.
(v)	Current flow due to drift velocity is I = neAv	(v)	No net current flow due to thermal velocity.

14. What is temperature co-efficient of resistance.

Ans. Temperature co-efficient of resistance:

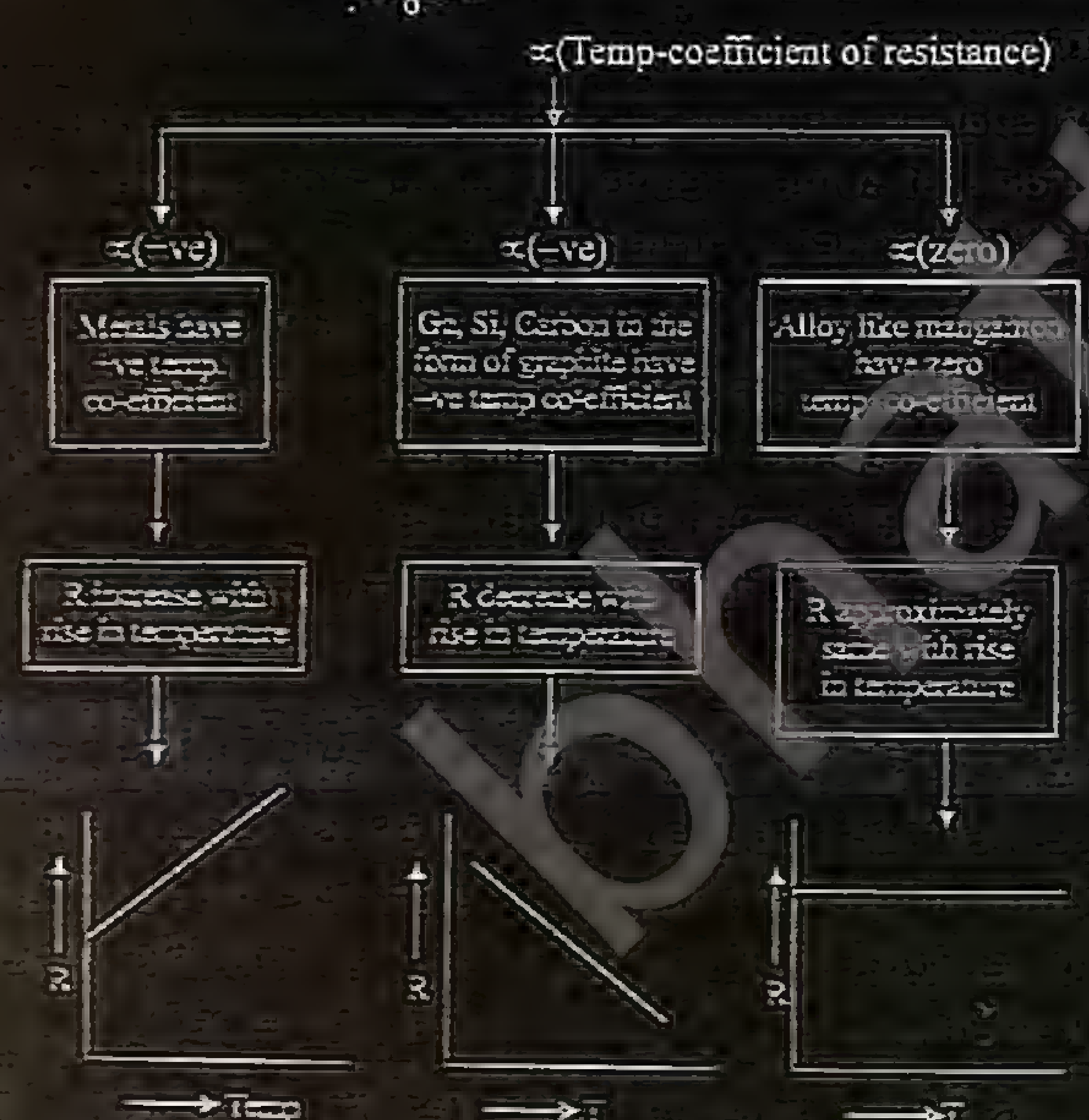
The temperature co-efficient of resistance ∝ is defined as fractional change in resistance per Kelvin rise in temperature.

Unit of ∝ in K^{-1}

R_0 is resistance at 0°C

R_t is resistance of high temp.

$$\alpha = \frac{R_t - R_o}{R_o \Delta T}$$



15. What are main function of a resistor?

Ans. Main function of resistor:

- To drop voltage
- To limit the current
- To dissipate electrical energy
- To dissipate electrical power

16. What is meant by current electricity or electrodynamics?

Ans. The branch of physics which deals with the study of moving charges is called current electricity or electrodynamics.

17. Name the charge carriers, in metallic conductors, solutions and gases.

Ans. (i) The charge carriers in metallic conductors are free electrons.

(ii) The charge carriers in electrolyte solution are positive and negative ions.

(iii) The charge carriers in gases are free electrons and ions.

18. What is difference between conventional current and electronic current?

Ans. (i) Conventional current flows from high potential towards low potential as it is the result of motion of positive charge carriers.

(ii) Electronic current flows from low potential towards high potential as it is the result of motion of negative charge carriers.

19. Why the net current through a metallic wire is zero in the absence of potential difference?

Ans. In the absence of potential difference, no electric field is set up so there is no directed motion of free electrons. So net flow of free electrons is zero.

20. Define electric current and its unit.

Ans. Time rate of flow of charge through any cross-section of conductor is called electric current.

$$I = \frac{\Delta q}{\Delta t}$$

The SI unit of current is ampere

ampere: When one coulomb charge passes through a conductor in one second then the current is said to be one ampere.

21. When sea eel senses danger then how it safe itself?

Ans. The sea eel at the time of danger can develop very strong potential difference upto 600 volts. This potential is generated between their head and tail and any one who enters their living zone may receive a great electric shock of about 600v.

22. Define the term drift velocity.

Ans. The average (uniform) velocity acquired by the free electrons in a conductor by application of extremely applied electric field is called drift velocity. Its value is of the order of $10^{-3}\ ms^{-1}$.

23. What is meant by source of current? Name some different sources of current?

Ans. The device which converts the non-electrical form of energy into electrical form of energy is called source of current. The examples of source of current are cell, generator, thermocouple, solar cell etc.

24. Derive the expression for Joule heating effect?

Ans. As power is defined:

$$P = \frac{W}{t}$$

$$\text{Or} \quad W = P \times t \qquad \because P = I^2R$$

$$\text{Or} \quad H = I^2Rt \quad (W = H)$$

25. Give some uses of heating effects of current.

Ans. Some uses of heating effects current are:

(i) Electrical iron
(ii) Electrical heater
(iii) Electrical toaster etc.

26. What is thermister? Write its use?

Ans. It is a heat sensitive resistor which is made up of metal oxides semi conductor materials.

(i) Thermister can be used to measure the very low value of temperature upto 10K.
(ii) They can be used to convert temperature variations into electric voltage. (Sgd 2006)

27. Give some uses of magnetic effects of current

Ans. Some uses of magnetic effects of current are:

(i) Electrical motor, electric fans
(ii) Electric measuring devise like Galvameter, ammeter etc. (Lhr 2005)

28. Under what circumstance the Ohm's law is applicable?

Ans. Ohm's law is applicable only when physical state of the conductor remains constant (i.e. temperature remains constant). So that resistance remain constraint.

29. Differentiate between Ohmic and non-Ohmic conductors.

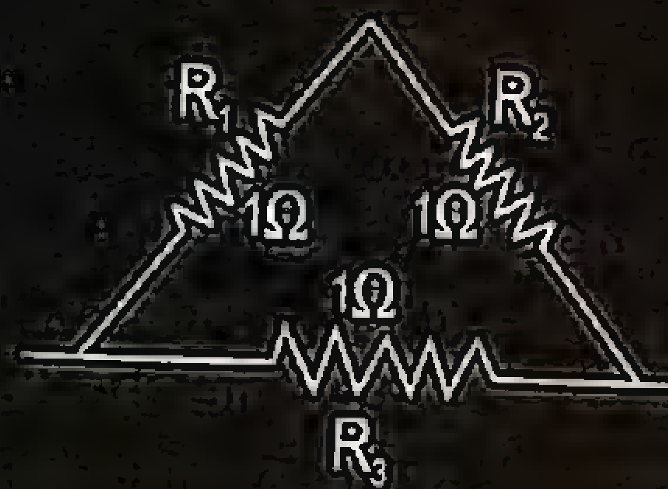
Ans. The materials which obey the Ohm's law are called Ohmic conductors and which do not obey Ohm's law are called non-Ohmic conductors.

30. Does the semi-conductor devices are Ohmic or non-Ohmic?

Ans. Since the semi-conductor are highly temperature dependent materials whose resistance varies inversely with increase in temperature. As the resistance does not remain constant so semi- conductors devices are non-Ohmic.

31. Three resistors each of one ohm are arranged in form of a triangle then calculate their equivalent resistance across any two terminals?

Ans. Equivalent Resistance of R_1 and R_2



$$R' = R_1 + R_2 = 1 + 1 = 2\ \Omega$$

Equivalent resistance of R' and R_3

$$\frac{1}{R_{eq}} = \frac{1}{R'} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{1}$$

$$\frac{1}{R_{eq}} = \frac{3}{2}$$

$$R_{eq} = \frac{2}{3}\ \Omega$$

32. Name the dependence factors of electrical resistance?

Ans. Electrical resistance depends upon:

(i) Nature of material
(ii) Length of conductor
(iii) Area of cross-section
(iv) Temperature of material

33. Differentiate between resistance and resistivity?

Ans. **Resistance:**

(i) The opposition in the flow of electrons through the conductor is called electrical resistance.
(ii) It depends upon the length and area of cross-section of the wire of a conductor (i.e. $R = \rho\frac{L}{A}$).
(iii) Its unit is Ohm (Ω)

Resistivity:

(i) It is the resistance of a meter cube of a wire.

(ii) It only amity independent of dimension of the conductors depends upon the nature and temperate of the material of the wire.

(iii) Its SI unit is ohm-meter (Ω-m). (Lhr 2008, Rwp 2005)

36. A platinum wire has resistance of 10Ω at 0C° and 20Ω at 273°C. Find the value of temperature co-efficient of resistance of platinum.

Ans. As $R_o = 10\Omega$, $R_t = 20\Omega$, $t = 546 - 273 = 273K$

$$\alpha = \frac{R_t - R_o}{R_o t} = \frac{20-10}{10 \times 273} = 3.66 \times 10^{-3} K^{-1}$$

37. How the cracks in the bridges can be checked by carbon fibers?

Ans. The reliability of concrete bridge made with carbon fibers can be checked. As fibers conduct electricity. If sensors show that electrical resistance is increasing over time the fibers are separating because of cracks. In this way cracks in the bridges can be checked by carbon fibers.

38. What is meant by tolerance value of a carbon resistor?

Ans. The possible variation from marked value of carbon resistor is called tolerance value.

39. What is a substrate?

Ans. The resistive material of carbon is spread in the form of thin coating on a high grade ceramic rod called substrate.

40. Give the working principle of rheostat?

Ans. The working principle of rheostat is that the resistance of the wire is directly proportional to length.

41. An ordinary bulb is marked 60 watt, 200 volts. What is its resistance?

Ans. P = 60 watt, V = 200 volts, R = ?

As $P = \frac{V^2}{R}$ or $R = \frac{V^2}{P}$ Putting values, we get

$$R = \frac{(200)^2}{60} = \frac{200 \times 200}{60} = 666.6\ \Omega$$ (Rwp 2006)

42. Define kWh and show that 1kWh = 3.6 MJ.

Ans. Kilowatt hour is the commercial unit of electrical energy and can be defined as, the amount of energy delivered by the current in one hour when it supplies energy at the rate of 1000 J/S.

$$1\text{ kWh} = 1\text{ kW } 1\text{ hr.}$$
$$= 1000\text{ W} \times 3600\text{ sec}$$
$$= 1000\frac{J}{s} \times 3600s = 36 \times 10^5 J = 3.6 \times 10^6 J = 3.6\text{ MJ}$$ (Grw 2008)

43. Find the heat dissipated through a bulb of 200 w in an hour?

Ans. As heat dissipated is given by the formula:

$$H = P \times t$$
$$= 200 \times 1\text{ hour}$$
$$= 200 \times 3600S$$
$$= 72 \times 10^4 J$$

44. What is meant by internal resistance of the cell?

Ans. The resistance offered by the electrolyte of the cell is called internal resistance of the cell.

It is denoted by r. (Fsd 2003, Grw 2008)

45. Is there any possibility when the terminal potential difference of the cell may exceed from emf of the cell?

Ans. Yes, during the charging of the cell, the terminal potential difference of the cell may exceed from its emf. So, $V_t = E + Ir$ (Fsd 2005)

46. Write down the procedure to solve the electrical circuit by Kirchhoffs rules?

Ans. (i) Draw the circuit diagram.

(ii) The choice of loops should be such that each resistance is included at least once in the selected loops.

(iii) Assume a loop current in each loop and direction of current remain same.

(iv) Write the loop equations for all loops

(v) Solve these equations for the unknown quantities.

47. What is wheat stone bridge and what is its use?

Ans. Wheat stone bridge is an electrical circuit used for determination of the value of unknown resistance.

In practical, slide wire bridge is its application.

48. What is potentiometer, give its uses?

Ans. Potentiometer is an device which draws no current and gives the accurate measurement about emf of cell. It is used to find unknown emf of a cell, continuously potential divider and to compare the emf of two cells.

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. The 'emf' is always ______ even when no current is drawn through the battery or cell.
   (a) Zero (b)Present (c) Absent (d) Maximum
2. In liquids and gases, the current is due to the motion of:
   (a) Negative charges (b) Positive charges
   (c) Neutral particles (d) Both negative and positive charges
3. A wire of resistance R is cut into two equal parts, its resistance becomes R/2. What happens to resistivity:
   (a) Double (b) Same (c) Half (d) One fourth
4. Current flows in the gases due to
   (a) electrons only (b) electrons and ions
   (c) positive and negative ions (d) electrons and holes
5. The power output of the lamp is 6W, how much energy does the lamp give out in 2 minutes?
   (a) 3 J (b) 12 J (c) 120 J (d) 720 J
6. Siemen is the unit of
   (a) resistance (b) conductance
   (c) resistivity (d) conductivity
7. The resistivity of a conductor increases with increase in
   (a) length (b) area (c) temperature (d) decrease in length
8. Power dissipation is expressed by
   (a) $P = V/R$ (b) $P = RV$ (c) $RV^2 = P$ (d) $P = I^2R$
9. Whenever current is drawn from a cell, its terminal potential difference and emf becomes
   (a) different (b) same (c) zero (d) negative
10. A rheostat can operate as a
    (a) Transformer (b) amplifier

    (c) oscillator (d) potential divider
11. The algebraic sum of potential changes for a closed circuit is
    (a) positive (b) negative
    (c) zero (d) greater than unity
12. The values of temperature coefficient of resistance of most thermistors is
    (a) positive (b) negative (c) zero (d) infinity
13. Electromotive force is closely related to
    (a) electric field intensity (b) magnetic field density
    (c) potential difference (d) inductance
14. Which one is used to determine the internal resistance of the cell
    (a) ammeter (b) voltmeter (c) galvanometer (d) potentiometer
15. Free electrons are
    (a) tightly bound (b) fixed
    (c) loosely bound (d) tightly fixed
16. The proportionality constant between current and potential difference is
    (a) P (b) R (c) 1/R (d) V
17. If the conductivity of the material is small then it is
    (a) conductor (b) poor conductor (c) good conductor (d) insulator
18. Thermistors are
    (a) a resistor (b) thermally sensitive resistor
    (c) an adiabatic resistor (d) an isothermal resistor
19. Electrical energy is measured in
    (a) watt (b) horse power (c) kilowatt (d) kilowatt hour
20. The maximum power delivered by battery is
    (a) $P_{max} = E^2/4r$ (b) $P_{max} = 4rE^2$ (c) $P_{max} = VIt$ (d) unlimited

Answers Key:

1.	(b)Present	11.	(c) zero
2.	(d) Both negative and positive charges	12.	(b) negative
3.	(b) Same	13.	(c) potential difference
4.	(b) electrons and ions	14.	(d) potentiometer
5.	(d) 720 J	15.	(c) loosely bound
6.	(b) conductance	16.	(b) R
7.	(c) temperature	17.	(d) insulator

8.	(d) $P = I^2R$	18.	(b) thermally sensitive resistor
9.	(a) different	19.	(d) kilowatt hour
10.	(d) potential divider	20.	(a) $P_{max} = E^2/4r$

Chapter 14 ELECTROMAGNETISM

Topic Wise MCQ's

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer:

Magnetic Field Due To Current In A Long Straight Wire, Force On A Current Carrying Conductor In A Uniform Magnetic Field

1. A changing magnetic field produces
   (a) coulomb's field (b) electric current
   (c) gravitational field (d) none of these
2. A magnetic field is always set up due to
   (a) motion of magnet (b) motion of charge
   (c) static electric charge (d) all of these
3. A current carrying wire is surround by
   (a) electric field only
   (b) magnetic field only
   (c) both electric field and magnet field
   (d) gravitational field
4. The magnetic effect near the current carrying conductor was discovered by
   (a) Coulomb (b) Bohr
   (c) Faraday (d) Hans Oersted
5. If a current is passing through a wire, lines of force near it are
   (a) parallel to the wire
   (b) perpendicular to the wire
   (c) inclined to the wire
   (d) in the shape of concentric circles

8.	(d) $P = I^2R$	18.	(b) thermally sensitive resistor
9.	(a) different	19.	(d) kilowatt hour
10.	(d) potential divider	20.	(a) $P_{max} = E^2/4r$

❀❀❀❀❀

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   (a) parallel to the wire
   (b) perpendicular to the wire
   (c) inclined to the wire
   (d) in the shape of concentric circles

6. In a straight current carrying conductor, the direction of magnetic field can be found by.
(a) right hand rule (b) left hand rule
(c) head to tail rule (d) all of these

7. The direction of lines of force depends upon the direction of
(a) flux (b) current
(c) both of these (d) none of these

8. Two lines of magnetic force
(a) can cross each other (b) always cross each other
(c) can never cross each other (d) none of these

9. The magnetic field at a point due to a current carrying conductor is directly proportional to
(a) thickness of the conductor
(b) resistance of the conductor
(c) current passing through the conductor
(d) distance from the conductor

10. Electric current generates
(a) electric field (b) magnetic field
(c) conservative field (d) gravitational field

11. The source of magnetic field is
(a) a current loop (b) a static electric charge
(c) a isolated north pole (d) an isolated south pole

12. When a current carrying conductor is placed in a uniform magnetic field, it experience a force which is given by
(a) $\vec{F} = I(\vec{L} \times \vec{B})$ (b) $\vec{F} = I(\vec{L} \cdot \vec{B})$
(c) $\vec{F} = \frac{I\vec{L}}{\vec{B}}$ (d) none of these

13. A current carrying straight conductor is placed in a magnetic field parallel to it. The force experienced by the conductor is
(a) $\vec{F} = I(\vec{L} \times \vec{B})$ (b) $F = ILB \tan\theta$
(c) $F = ILB \cos\theta$ (d) $F = 0$

14. A current carrying straight conductor is placed in a magnetic field perpendicular to it, the force experienced by the conductor is

(a) $F = 0$ (b) $F = ILB \sin\theta$
(c) $F = ILB$ (d) $F = ILB \cos\theta$

15. A current carrying conductor is placed at right angle to the magnetic field. The magnetic force experienced by the conductor is
(a) minimum (b) maximum
(c) zero (d) none of these

16. A current carrying conductor experiences maximum magnetic force in a uniform magnetic field when it is placed
(a) at an angle of 60° to the field
(b) perpendicular to the field
(c) parallel to the field
(d) at an angle of 180° to the field

17. Two parallel straight wires carrying currents in opposite direction
(a) repel each other
(b) attract each other
(c) have no effect upon each other
(d) they cancel out their individual magnetic fields

18. Two parallel straight wires carrying currents in same direction
(a) repel each other
(b) attract each other
(c) have no effect upon each other
(d) they cancel out their individual magnetic fields

19. If the current passing through a wire in a magnetic field is halved the magnetic force would become
(a) half (b) twice
(c) four times (d) six times

20. A current flowing away from the reader (into page) is denoted by the symbol
(a) dot (.) (b) cross (×)
(c) line (_) (d) none of these

21. A current flowing toward the reader (out of page) is denoted by the symbol
(a) dot (.) (b) cross (×)
(c) line (-) (d) none of these

22. The SI unit of magnetic induction is

(a) gauss
(b) tesla
(c) weber
(d) coulomb

23. Magnetic induction is also called
(a) flux
(b) magnetic pole
(c) magnetic flux density
(d) all of these

24. One tesla is equal to
(a) $1\ N\ A\ m^{-1}$
(b) $1\ N^{-1}\ A\ m^{-1}$
(c) $1\ N\ A^{-1}\ m$
(d) $1\ N\ A^{-1}\ m^{-1}$

25. One Tesla is equal to
(a) $1\ Wb\ m^{2}$
(b) $1\ Wb\ m^{-2}$
(c) $1\ Wb\ m^{-1}$
(d) $1\ Wb\ m$

26. The relation between Gauss (G) and Tesla (T) is given by
(a) $1\ G = 10^{-1}\ T$
(b) $1\ G = 10^{-2}\ T$
(c) $1\ G = 10^{-3}\ T$
(d) $1\ G = 10^{-4}\ T$

27. A 5 meter wire carrying a current of 2 A is at right angles to the uniform magnetic field of 0.5 weber/m^2. The force on the wire is
(a) 1.5 N
(b) 2 N
(c) 4 N
(d) 5 N

Magnetic Flux And Flux Density, Ampere's Law And Determination Of B Due To Current Carrying Solenoid

28. Total number of lines of magnetic induction passing through any surface placed perpendicular to the field is called:
(a) flux density
(b) magnetic induction
(c) magnetic flux
(d) self inductance

29. Magnetic flux mathematically is defined as
(a) $\Phi = \vec{B}.\vec{A}$
(b) $\Phi = \vec{B}\times\vec{A}$
(c) $\Phi = \vec{E}.\vec{A}$
(d) $\Phi = \vec{B}\times\vec{A}$

30. Magnetic flux will be maximum when
(a) magnetic field is perpendicular to the plane area
(b) magnetic field lies parallel to the plane area
(c) Area is held at an angle of 45°
(d) none of these

31. Magnetic flux will be minimum when
(a) Magnetic field lies perpendicular to the plane of area
(b) Magnetic field lies parallel to the plane of area
(c) Magnetic field is at an angle of 45^0 with surface area
(d) none of these

32. SI unit of magnetic flux is
(a) $Nm\ A^{-1}$
(b) $NA\ m^{-1}$
(c) $Nm\ A^{-2}$
(d) $Nm^{2}\ A^{-1}$

33. The unit of magnetic flux is
(a) weber
(b) weber-m^2
(c) weber-m^{-2}
(d) gauss

34. weber is the unit of
(a) magnetic field intensity
(b) magnetic induction
(c) magnetic flux
(d) magnetic flux density

35. The SI unit of flux density is
(a) $N\ A\ m^{-1}$
(b) $N\ A^{-1} m^{-1}$
(c) $N\ A^{-1} m$
(d) $N\ m^{-1}\ A^{-2}$

36. The unit of flux density is also given by:
(a) Wb/m^{-1}
(b) Wb/m^{2}
(c) Wb
(d) Wb/m

37. The magnetic flux will be maximum, when
(a) θ = 90°
(b) θ = 0
(c) θ = 60°
(d) θ = 90°

38. A 0.50 T field over an area of 2 m^2 which lies at an angle of 30° to the field, the magnetic flux is
(a) 0.50 Weber
(b) 0.15 Weber
(c) 1.0 Weber
(d) 1.5 Weber

39. Magnetic flux per unit area perpendicular to magnetic field is called
(a) self induction
(b) flux density
(c) mutual induction
(d) self-induction

40. Ampere's law can be used to calculate ______ field
(a) electric
(b) magnetic
(c) gravitational
(d) all of these

41. In SI units, the value of permeability of free space (μ_o) is
(a) $4\pi \times 10^{7}$ Wb $A^{-1} m^{-1}$ (b) $4\pi \times 10^{-7}$ Wb $A^{-1} m^{-1}$
(c) $4\pi \times 10^{9}$ Wb $A^{-1} m^{-1}$ (d) $4\pi \times 10^{-9}$ Wb $A^{-1} m^{-1}$

42. The SI, units of magnetic permeability is
(a) weber/m^2 (b) weber
(c) weber/Am (d) weber/Am^2

43. A long tightly wound cylindrical coil of wire is called
(a) solenoid (b) toroid
(c) both of these (d) none of these

44. Magnetic field inside a long solenoid is:
(a) uniform (b) non-uniform
(c) circular (d) negligible

45. Which of the following is most suitable for the core of an electromagnet?
(a) air (b) steel
(c) soft iron (d) an alloy

46. Magnetic flux density due to current carrying conductor can be determined by
(a) Gauss's law (b) Faraday's law
(c) Ampere's law (d) Coulomb's law

47. The magnetic field in a certain region is given by $\vec{B} = 40\hat{i} - 18\hat{j}$. How much flux passes a 5.0 cm^2 area loop in this region if the loop lies flate in the xy – plane
(a) 90×10^{-4} Wb (b) 200×10^{-4} Wb
(c) 110×10^{-4} Wb (d) Zero

48. Magnetic field along the axis of a solenoid with N turns carrying a current I is given by
(a) $B = \mu_o NI$ (b) $B = \mu_o/NI$
(c) $B = \mu_o nI$ (d) $B = \mu_o I/n$

49. The mathematical expression $\sum(\vec{B}.\vec{\ell}) = \mu_o I$ is known as
(a) Lenz's law (b) Ampere's law
(c) Gauss's law (d) Faraday's law

50. The magnetic field outside the solenoid due to current is
(a) strong (b) weak
(c) zero (d) uniform

51. When current passes through a solenoid coil, it behaves like a
(a) circular magnet (b) bar magnet
(c) north pole (d) none of these

Force On Moving Charge In A Magnetic Field, Motion Of Charge Particle In An Electric And Magnetic Field

52. The force experienced by a single charge carrier moving with velocity $\vec{v}$ in a magnetic field of strength $\vec{B}$ is given by
(a) $\vec{F} = q(\vec{v} . \vec{B})$ (b) $\vec{F} = q(\vec{v} \times \vec{B})$
(c) $\vec{F} = q(\vec{v} + \vec{B})$ (d) $\vec{F} = q(\vec{v} - \vec{B})$

53. If an electron enters the perpendicular magnetic field with a velocity $\vec{v}$, it will experience a force which is given by F=
(a) zero (b) ev/B
(c) $\frac{e}{vB}$ (d) evB

54. The force experienced by a charge particle is maximum, if it moves:
(a) perpendicular to magnetic field
(b) parallel to magnetic field
(c) opposite to magnetic field
(d) none of these

55. A charge projected in the direction of magnetic field experiences
(a) maximum force (b) no force
(c) finite force (d) none of these

56. The magnetic force experienced by a charge particle is zero, when charge particle is projected at
(a) $\theta = 0°$ (b) $\theta = 45°$
(c) $\theta = 90°$ (d) $\theta = 120°$

57. The magnetic force experienced by a charge particle is maximum, when charge particle is projected at
(a) $\theta = 0°$ (b) $\theta = 45°$
(c) $\theta = 90°$ (d) $\theta = 180°$

58. The force experienced, when neutron is projected in a magnetic field with velocity $\vec{v}$ is

(a) $\vec{F} = q(\vec{v} \times \vec{B})$ (b) $\vec{F} = -q(\vec{v} \times \vec{B})$

(c) zero (d) $\vec{F} = e(\vec{v} \times \vec{B})$

59. The force $\vec{F}$, in the equation, $\vec{F} = \vec{F}_e + \vec{F}_b$ is called

(a) deflecting force (b) restoring force

(c) frictional force (d) Lorentz force

60. Lorentz force is given by

(a) $\vec{F}=q[(\vec{V}.\vec{B})+\vec{E}]$ (b) $\vec{F}=q[(\vec{V}\times\vec{B})+\vec{E}]$

(c) $\vec{F}=q[(\vec{V}+\vec{B})+\vec{E}]$ (d) $\vec{F}=q[(\vec{V}.\vec{B})\vec{E}]$

61. When a charged particle moves through a magnetic field, the effect of the field, changes the particle's

(a) speed (b) mass

(c) energy (d) direction of motion

62. Which of the following particle moving in the magnetic field cannot be deflected

(a) α-particle (b) β-particle

(c) electron (d) neutron

63. The magnetic force is simply a

(a) restoring force (b) Lorentz force

(c) deflecting force (d) all of these

64. When charged particle enters perpendicular in magnetic field, it moves in

(a) straight path (b) circular path

(c) helical path (d) none of these

65. Magnetic force performs

(a) maximum work (b) no work

(c) negative work (d) none of these

66. An electron travels from left to right in the plane of the paper in a magnetic field perpendicular to and directed into the paper, it is deflected

(a) downward direction (b) upward direction

(c) plane of area out of the (d) none of these

67. A proton travels from left to right in the plane of the paper in a magnetic field perpendicular to and directed into the paper, it is deflected

(a) downward direction (b) upward direction

(c) out of plane of paper (d) none of these

68. When an electron enters in a perpendicular magnetic field of its motion, then direction of its motion

(a) remains same (b) changes at every instant

(c) becomes parallel to field (d) none of these

69. When an electron enters in a magnetic field, right angle to its motion, then the magnitude of velocity will be

(a) changed (b) unchanged

(c) zero (d) none of these

Determination Of e/m Of An Electron, Cathode Ray Oscilloscope, Torque On Current Carrying Coil

70. The e/m of an electron moving in a circular path in a magnetic field is given by

(a) v/Br (b) v^2/Br

(c) B/vr (d) B^2/vr

71. When charged particle is projected perpendicular to a uniform magnetic field, its trajectory is

(a) straight line (b) a circle

(c) an ellipse (d) none of these

72. In e/m experiment, the path of the electron can be made visible by filling glass tube with

(a) O_2 gas at high pressure (b) H_2 gas at high pressure

(c) H_2 gas at low pressure (d) air at low pressure

73. The e/m of an electron can be expressed as

(a) $e/m=\frac{2V}{Br}$ (b) $e/m=\frac{V}{2Br}$

(c) $e/m=\frac{2V}{Br^2}$ (d) $e/m=\frac{2V}{B^2r^2}$

74. Charge to mass ratio of neutron is ________ that of electron

(a) equal to (b) less then

(c) greater then (d) none of these

75. Charge to mass ratio (e/m) of a proton is ______ that of electron

(a) equal to (b) greater then
(c) less then (d) none of these

76. In velocity selector a charged particle will go undeflected if its velocity υ is equal to
(a) EB (b) B/E
(c) E/B (d) E + B

77. Which one of the following field is suitable choice for circular trajectory of a charged particle
(a) gravitational field (b) electric field
(c) magnetic field (d) all of these

78. A high speed graph plotting device is
(a) AVO meter (b) television
(c) CRO (d) all of these

79. Cathode ray oscilloscope works by deflecting beam of
(a) electrons (b) protons
(c) neutrons (d) positrons

80. The beam of electrons in CRO is deflected, when they pass through uniform
(a) electric field (b) magnetic field
(c) gravitational field (d) all of these

81. The electron gun in CRO consists of
(a) grid (b) filament
(c) indirectly heated cathode (d) all of these

82. The grid in CRO
(a) controls the number of electrons by cathode
(b) controls the brightness of spot formed on screen
(c) both (a) and (b)
(d) none of these

83. In CRO, the x-plates deflect the beam of electrons ________ on screen.
(a) horizontally (b) vertically
(c) parallel to x-axis (d) both a and c

84. The brightness of the spot on CRO screen is controlled by
(a) cathode (b) anode
(c) grid (d) plates

85. In CRO the grid is at ________ potential with respect to cathode.

(a) positive (b) negative
(c) zero (d) none of these

86. In CRO when beam of electrons falls on screen, it makes a visible spot because the screen is
(a) polished (b) rough
(c) clear (d) fluorescent

87. In CRO when cathode is heated by a filament, it emits
(a) neutrons (b) radiations
(c) electrons (d) protons

88. CRO is used for displaying the wave form of a given
(a) AC voltage (b) DC voltage
(c) both a and b (d) none of these

89. The waveform produced by sweep or time base generator in CRO is
(a) sine wave (b) square wave
(c) saw tooth wave (d) none of these

90. In CRO, beam of electrons is focused by
(a) cathode (b) grid
(c) anode (d) both a & c

91. Torque on a current carrying coil placed perpendicular to a magnetic field is given by
(a) $\tau = 0$ (b) $\tau = ILB \sin\alpha$
(c) $\tau = IBA \cos\alpha$ (d) $\tau = IBA \sin\alpha$

Galvanometer

92. A device used for the detection of current is called
(a) AVOmeter (b) voltmeter
(c) galvanometer (d) ammeter

93. The pointer of dead- beat galvanometer gives a steady deflection because
(a) Its magnet is very strong
(b) eddy currents are produced in the conducting frame over which the wire is wound.
(c) Its pointer is very light
(d) all of these

94. The magnitude of the deflecting torque produced in the coil of galvanometer is
(a) $\tau = NIBA \sin\alpha$ (b) $\tau = NIBA \cos\alpha$

(c) τ = NIBA tanα (d) zero

95. If the plane of the rectangular coil is parallel to the magnetic field (i.e., radial magnetic field), the torque on the coil is:
(a) τ = NIBA cos α (b) NIBA sin α
(c) zero (d) NIAB

96. The working of galvanometer depends upon torque on a current carrying coil in
(a) electric field (b) magnetic field
(c) gravitational field (d) all of these

97. In a moving coil galvanometer, the deflecting torque depends upon
(a) area of the coil (b) number of turns of coil
(c) value of magnetic field (d) all of these

98. Torque necessary to produce unit twist is called ________
(a) deflecting torque (b) torsional constant
(c) restoring torque (d) all of these

99. Sensitivity of galvanometer is given by
(a) $\frac{C}{BAN}$ (b) $\frac{CA}{BN}$
(c) $\frac{BAN}{C}$ (d) $\frac{BN}{CA}$

100. In western type galvanometer, the jeweled bearings are used produced
(a) deflecting torque (b) restoring torque
(c) both a & b (d) none

101. The working of all electrical instruments depends upon:
(a) heating effect of current (b) chemical effect of current
(c) magnetic effect of current (d) all of these

102. The working of a galvanometer depends upon
(a) electric force exerted on the coil
(b) torque produced in the coil
(c) material of the coil
(d) mass of the coil

103. In galvanometer the coil is situated in the magnetic field such that the plane of the coil is always
(a) parallel to the field (b) perpendicular to the field

(c) at 45° to the field (d) at 60° to the field

104. The current passing through a coil of galvanometer is given by
(a) $I = \frac{BAN}{C}\theta$ (b) $I = \frac{C}{BAN}\theta$
(c) $I = \frac{BAN}{C\theta}$ (d) $I = \frac{NAC}{B\theta}$

105. The relation between current I and the angle of deflection in a moving coil galvanometer is:
(a) $I \propto \frac{1}{\theta}$ (b) $I \propto \cos\theta$
(c) $I \propto \theta$ (d) $I \propto \sin\theta$

106. The galvanometer can be made sensitive by decreasing the value of:
(a) A (b) N
(c) C (d) B

107. The galvanometer can be made sensitive if the value of the factor $\frac{BAN}{C}$ is
(a) made larger (b) made small
(c) remains constant (d) none of these

108. The current passing through coil of the galvanometer is:
(a) directly proportional to the angle of deflection
(b) inversely proportional to the angle of deflection
(c) Directly proportional square of angle of defection
(d) none of these

109. Sensitivity of Galvanometer can be increased by increasing
(a) B (b) A
(c) N (d) all of these

110. In western type galvanometer, the jewelled bearings are used produce
(a) deflecting torque (b) restoring torque
(c) both a & b (d) None

111. In galvanometer, the rectangular coil is made up of
(a) enameled copper wire (b) enameled steel wire
(c) Iron wire (d) none of these

112. In a galvanometer, the enameled copper wire is wound on:

(a) an insulator (b) magnetic material
(c) non-magnetic material (d) an iron frame

113. When the coil of the galvanometer is in equilibrium, then the deflecting couple is
(a) zero
(b) equal to the restoring couple
(c) greater than the restoring couple
(d) smaller than the restoring couple

114. The sensitivity of a moving coil galvanometer can be increased by
(a) decreasing the area of the coil
(b) decreasing the number of turns of coil
(c) increasing the magnetic field
(d) both b & c

115. The galvanometer in which the coil comes to rest quickly after the current passed through it, is called
(a) stable galvanometer (b) dead beat galvanometer
(c) both (a) and (b) (d) sensitive galvanometer

116. In galvanometer, the restoring couple of the suspension wire is proportional to the angle of deflection as long as the wire obeys
(a) Lenz's law (b) Faraday's law
(c) Ampere's law (d) Hook's law

117. Minimum current required to produce a deflection of one mm on a scale at a distance of 1 meter is
(a) 1 coulomb (b) 1 ampere
(c) current sensitivity (d) 1 ohm

Ammeter, Voltmeter, AVOmeter, Multimeter

118. An ideal ammeter has __________ resistance
(a) infinite (b) 100MΩ
(c) zero (d) none of these

119. The resistance of an ideal voltmeter is
(a) zero (b) 100Ω
(c) 10MΩ (d) infinite

120. A galvanometer is converted into an ammeter by connecting a suitable
(a) high resistance in series with the galvanometer

(b) high resistance in parallel with the galvanometer
(c) low resistance in series with the galvanometer
(d) low resistance in parallel with the galvanometer

121. Ammeter is a
(a) low resistance galvanometer
(b) high resistance galvanometer
(c) intermediate resistance galvanometer
(d) infinite resistance galvanometer

122. An ammeter only can be used in __________ in a circuit
(a) series (b) parallel
(c) both series and parallel (d) none of these

123. In order to increase the range of an ammeter, the shunt resistance is
(a) decreased (b) increased
(c) kept constant (d) sometimes is increased and sometimes decreased

124. To convert a galvanometer into an ammeter, of range I ampere the shunt resistance is given by
(a) $R_s = \frac{I_g R_g}{I + I_g}$ (b) $R_s = \frac{I_g R_g}{I - I_g}$
(c) $R_s = \frac{I - I_g}{I_g R_g}$ (d) $R_s = \frac{I - I_g}{I_g R_g}$

125. An ideal ammeter has _________ resistance
(a) Very high (b) infinite
(c) low (d) zero

126. A low resistance which can by pass a current is called
(a) multiplier (b) divider
(c) shunt (d) high resistance

127. A voltmeter is an electrical instrument which is used to measure
(a) current (b) resistance
(c) potential difference (d) all of these

128. Galvanometer can be converted into voltmeter by connecting a high resistance in:
(a) parallel with galvanometer

(b) series with galvanometer
(c) parallel as well as series with the galvanometer
(d) none of these

129. In order to increase the range of voltmeter, the series resistance is
(a) kept constant (b) decreased
(c) increased (d) sometimes increased and sometimes decreased

130. If a high resistance is connected in series with the galvanometer the resulting instrument is called
(a) a voltmeter (b) an ammeter
(c) a potentiometer (d) an AVO meter

131. A voltmeter is always connected in circuit in
(a) parallel (b) series
(c) both a and b (d) none of these

132. The high resistance R_h to convert a galvanometer into a voltmeter is R_h=
(a) $R_g - \frac{V}{I_g}$ (b) $\frac{I_g}{I - I_g}$
(c) $\frac{V}{I_g} - R_g$ (d) $\frac{V}{I_g} + R_g$

133. AVO meter is an instrument used to measure current , voltage and
(a) current (b) voltage
(c) capacitance (d) resistance

134. A device which can measure current, potential difference and resistance is called
(a) ammeter (b) Ohmmeter
(c) AVO meter (d) volt meter

135. Ohm meter is used to measure the
(a) current (b) resistance
(c) potential difference (d) power

136. AVOmeter basically consists of
(a) voltmeter (b) ammeter
(c) ohmmeter (d) moving coil galvanometer

137. A moving coil galvanometer can be converted into
(a) ammeter (b) voltmeter

(c) ohmmeter (d) all of these

138. DMM stands for
(a) digital multimeter (b) digital millimeter
(c) digit measuring meter (d) none of these

139. Which one of these can be used to determine the presence of a magnetic field in a given region of space
(a) galvanometer (b) AVO meter
(c) ammeter (d) a current loop

Answer Key's

1.	(b) electric current	2.	(b) motion of charge
3.	(b) magnetic field only	4.	(d) Hans Oersted
5.	(d) in the shape of concentric circles	6.	(a) right hand rule
7.	(b) current	8.	(c) can never cross each other
9.	(c) current passing through the conductor	10.	(b) magnetic field
11.	(b) a current loop	12.	(a) $\vec{F} = I(\vec{L} \times \vec{B})$
13.	(d) F = 0	14.	(c) F = ILB
15.	(b) maximum	16.	(b) Perpendicular to the field
17.	(a) repel each other	18.	(b) attract each other
19.	(a) half	20.	(b) cross (x)
21.	(a) dot (.)	22.	(b) tesla
23.	(c) magnetic flux density	24.	(d) 1 $NA^{-1} m^{-1}$
25.	(b) 1 $Wb\,m^{-2}$	26.	(d) 1 G = 10^{-4} T
27.	(d) 5 N	28.	(c) magnetic flux
29.	(a) $\Phi = \vec{B}.\vec{A}$	30.	(a) magnetic filed is perpendicular to the plane area
31.	(b) Magnetic field lies parallel to the plane of area	32.	(a) $Nm\,A^{-1}$
33.	(a) weber	34.	(c) magnetic flux

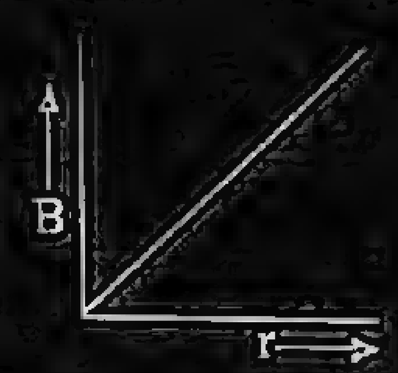
35.	(b) $N A^{-1} m^{-1}$	36.	(b) Wb/m^2
37.	(b) $\theta = 0^{\circ}$	38.	(a) 0.50 Weber
39.	(b) flux density	40.	(b) magnetic
41.	(b) $4\pi \times 10^{-7}$ Wb $A^{-1}m^{-1}$	42.	(c) weber/Am
43.	(a) solenoid	44.	(a) uniform
45.	(c) soft iron	46.	(c) Ampere's law
47.	(d) zero	48.	(c) $B = \mu_o nI$
49.	(b) Ampere's law	50.	(b) weak
51.	(b) bar magnet	52.	(b) $\vec{F} = q(\vec{v} \times \vec{B})$
53.	(d) evB	54.	(a) perpendicular to magnetic field
55.	(b) no force	56.	(a) $\theta = 0^{\circ}$
57.	(c) $\theta = 90^{\circ}$	58.	(c) zero
59.	(d) Lorentz force	60.	(b) $\vec{F} = q[(\vec{V} \times \vec{B}) + \vec{E}]$
61.	(d) direction of motion	62.	(d) neutron
63.	(c) deflecting force	64.	(b) circular path
65.	(b) no work	66.	(a) downward direction
67.	(b) upward direction	68.	(b) changes at every instant
69.	(b) unchanged	70.	(a) v/Br
71.	(b) a circle	72.	(c) H_2 gas at low pressure
73.	(d) $e/m = \frac{2V}{B^2r^2}$	74.	(d) none of these
75.	(c) less than	76.	(c) E/B
77.	(c) magnetic field	78.	(c) CRO
79.	(a) electrons	80.	(a) electric field
81.	(d) all of these	82.	(c) both a and b
83.	(a) horizontally	84.	(c) grid
85.	(b) negative	86.	(d) fluorescent
87.	(c) electrons	88.	(c) both a and b
89.	(c) saw tooth wave	90.	(c) anodes
91.	(c) $\tau = IBA \cos\alpha$	92.	(c) galvanometer

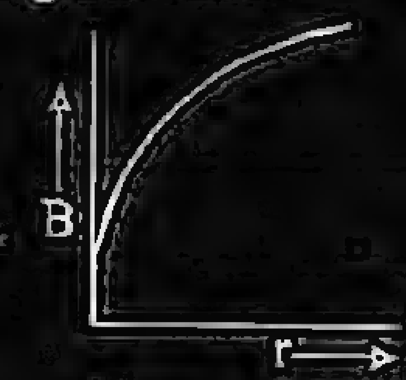
93.	(b) eddy currents are produced in the conducting frame over which the wire is wound.	94.	(b) $\tau = NIBA \cos\alpha$
95.	(d) NIAB	96.	(b) magnetic field
97.	(d) all of these	98.	(b) torsional constant
99.	(c) $\frac{BAN}{C}$	100.	(c) radial
101.	(c) magnetic effect of current	102.	(b) torque produced in the coil
103.	(a)	104.	(b) $I = \frac{C}{BAN}\theta$
105.	(c) $I \propto \theta$	106.	(c) C
107.	(a) made larger	108.	(a) directly proportional to the angle of deflection
109.	(d) all of these	110.	(b) restoring torque
111.	(a) enameled copper wire	112.	(c) non-magnetic material
113.	(b) equal to the restoring couple	114.	(c) increasing the magnetic field
115.	(b) dead beat galvanometer	116.	(d) Hook's law
117.	(c) current sensitivity	118.	(c) zero
119.	(d) infinite	120.	(d) low resistance in parallel with the galvanometer
121.	(a) low resistance galvanometer	122.	(a) series
123.	(a) decreased	124.	(b) $R_s = \frac{I_g R_g}{I - I_g}$
125.	(c) low	126.	(c) shunt
127.	(c) potential difference	128.	(b) series with galvanometer
129.	(c) increased	130.	(a) a voltmeter
131.	(a) parallel	132.	(c) $\frac{V}{I_g} - R_g$
133.	(d) resistance	134.	(c) AVO meter
135.	(b) resistance	136.	(d) moving coil galvanometer
137.	(d) all of these	138.	(a) digital multimeter
139.	(d) a current loop		

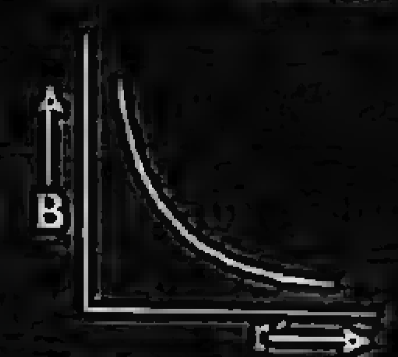
Brain Teasing MCQ's (with Hints)

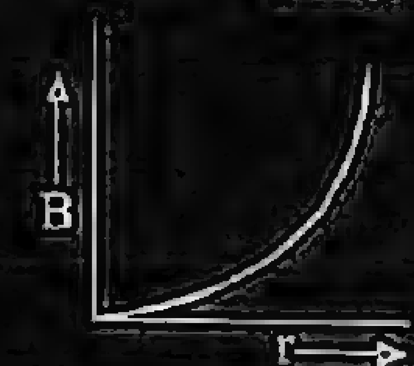
◊ Four possible answers to each statement are given below. Tick (✓) the correct answer.

1. Which of the following graphs shows the variation of magnetic induction B with distance r from a long wire carrying current?

(a) 

(b) 

(c) 

(d) 

2. If a long hollow copper pipe carries a direct current. The magnetic field due to current will be
   (a) only inside the pipe (b) only outside the pipe
   (c) both inside and outside the pipe (d) neither inside nor outside the pipe
3. A current carrying loop is placed in a uniform magnetic field. The torque acting on it, doest not depend upon
   (a) shape of loop (b) area of loop
   (c) current of loop (d) magnetic field
4. A strong magnetic field is applied to a stationary electron, then
   (a) electron move in the direction of field (b) electron move opposite to field
   (c) electron start spinning (d) electron remain stationary
5. Which of the following in motion can not be deflected by magnetic field?
   (a) electron (b) proton
   (c) neutron (d) sodium ion
6. When an electron is entered in a magnetic field, The magnitude of velocity of electron
   (a) increase (b) decrease

   (c) depends on field strength (d) is independent of field strength
7. A charged particle enters at 30° to the magnetic field. Its path becomes
   (a) helical (b) circular
   (c) ellipital (d) straight line
8. A power line lies along east-west direction and carries a current of 10A. Which of the following is the force per metre due to earth,s magnetic field of 10^{-4} tesla?
   (a) 10^{-2}N (b) 10^{-3}N
   (c) 10^{-4}N (d) 10^{-5}N
9. A uniform magnetic field is represented by a set of lines of force which are
   (a) parallel (b) convergent
   (c) divergent (d) none of these
10. A magnetic needle is kept in a non-uniform magnetic field. It experience.
    (a) force but not torque (b) torque but not force
    (c) a force and a torque (d) neither a force nor or torque
11. A current flows in a conductor from east to west. The direction of the magnetic field at a point above the conductor is towards.
    (a) East (b) West
    (c) North (d) South
12. Two parallel wire carrying current in the same direction attract each other because of
    (a) potential difference between them (b) mutual inductance between them
    (c) electric force between them (d) magnetic force between them
13. The radius of curvature of the path of charged particle in a uniform magnetic field is directly proportional to the
    (a) Charge an particle (b) momentum of particle
    (c) Energy of particle (d) intensity of magnetic field
14. A proton and α - particle moving with same velocity enter a magnetic field perpendicularly. Which of the following is the ratio of radius of proton to α - particle,
    (a) $\frac{1}{2}$ (b) 1
    (c) 2 (d) 4
15. In a current carrying long solenoid the magnetic filed produced does not depend upon

(a) number of turns per unit length (b) current flowing through solenoid
(c) The radius of solenoid (d) all of the above three

16. An electron is moving in a circle of radius r in a uniform magnetic field B. Suddenly the field is reduced to $\frac{B}{2}$. The radius of circle now becomes
(a) $\frac{r}{2}$ (b) $\frac{r}{4}$
(c) 2r (d) 4r

17. A horizontal wire of 10cm and mass 0.3gm carries a current of 5A. Which of the following is the magnitude of the magnetic field that can suppost the weight of wire? $(g = 10\frac{m}{s^2})$
(a) 6×10^{-3} T (b) 3×10^{-3} T
(c) 6×10^{-4} T (d) 3×10^{-4} T

18. A 2Mev proton is moving perpendicular to a uniform magnetic field of 2.5T. Which of the following is the magnetic force on proton?
(a) 2.5×10^{-10} N (b) 2.5×10^{-11} N
(c) 8×10^{-11} N (d) 8×10^{-12} N

19. An electron and a proton enter a magnetic field with same velocity. Which of the following is the ratio of their acceleration
(a) $\frac{m_p}{m_e}$ (b) $\frac{m_e}{m_p}$
(c) $\sqrt{\frac{m_p}{m_e}}$ (d) $\sqrt{\frac{m_e}{m_p}}$

20. A charged particle is moving in uniform magnetic field in a circle. The radius of circular path is R. If the energy of particle is doubled then the new radius will be
(a) $\frac{R}{\sqrt{2}}$ (b) $\frac{R}{2}$
(c) $\sqrt{2}R$ (d) 2R

21. A charged particle moves through a magnetic field in a direction perpendicular to it. Which of the following remain unchanged for the particle?
(a) velocity (b) speed
(c) acceleration (d) direction

22. A magnet drops down a long vertical copper tube. As it falls down the tube, its velocity.
(a) increase (b) decrease
(c) remain constant (d) none of above

23. A voltmeter of range lV has a resistance of 1000Ω. To extend the range to 10V the additional series resistance required is
(a) 1000 Ω (b) 9000Ω
(c) 10000Ω (d) 11000Ω

24. The resistance of ideal voltmeter is
(a) zero (b) very low
(c) very high (d) infinite

25. The resistance of an ideal ammeter
(a) zero (b) high
(c) small (d) infinite

26. Magnetic effect of current was discovered by
(a) Faraday (b) oersted
(c) Kirchhoff (d) Joule

27. A charged particle moves along a circle under the action of possible electric and magnetic fields. Which of the following is possible
(a) E = 0, B = 0 (b) $E \neq 0, B = 0$
(c) $E = 0, B \neq 0$ (d) $E \neq 0, B \neq 0$

28. The ray which remain undeflected in a magnetic field is
(a) α–rays (b) β– rays
(c) cathode rays (d) γ–rays

Answer with Hints

No.	Correct Option	Answers	Hint
1	c	$B \propto \frac{1}{r}$	
2	b	only outside the	

		pipe	
3	a	shape of loop	$T = NIAB\cos\theta$
4	d	electron remain stationary	
5	c	neutron	No effect of magnetic field on neutral particles
6	d	independent of field strength	
7	a	helical	
8	b	10^{-3}N	$F = ILB$
9	a	parallel	
10	c	force and torque	
11	c	north	
12	d	Magnetic force between then	
13	b	momentum of particle	$evB = \frac{mv^2}{r}$ $eB = \frac{mv}{r}$ $r = \frac{mv}{eB}$ $r = \frac{p}{eB}$
14	a	$\frac{1}{2}$	$r = \frac{mv}{qB}$ $\frac{r_p}{r_\alpha} = \frac{\frac{m_pV}{q_pB}}{\frac{m_\alpha V}{q_\alpha B}}$

			$\frac{r_p}{r_\alpha} = \frac{\frac{m_pV}{eB}}{\frac{4m_pV}{2eB}}$ $\frac{r_p}{r_\alpha} = \frac{m_pV}{eB} \times \frac{2eB}{4m_pV}$ $\frac{r_p}{r_\alpha} = \frac{1}{2}$
15	c	radius of solenoid	$B = \mu_o nI$
16	c	2r	$r = \frac{mv}{eB}$
17	a	6×10^{-3}T	$ILB = mg$ $B = \frac{mg}{IL}$
18	d	8×10^{-12} N	$F = qBv$ But $v = \sqrt{\frac{2E}{m}}$ $F = qB\sqrt{\frac{2E}{m}}$
19	a	$\frac{m_p}{m_e}$	$a_e = \frac{F}{m_e} = \frac{evB}{m_e}$ $ap = \frac{F}{m_p} = \frac{evB}{m_p}$ $\frac{a_e}{a_p} = \frac{m_p}{m_e}$
20	c	$\sqrt{2}R$	$R = \frac{mv}{qB}$ $v = \sqrt{\frac{2E}{m}}$

			$R = \frac{m}{qB}\sqrt{\frac{2E}{m}} = \frac{1}{qB}\sqrt{2Em}$ When energy is double $R' = \frac{1}{qB}\sqrt{2(2E)m}$ $R' = \sqrt{2}\left[\frac{1}{qB}\sqrt{2Em}\right]$ $R' = \sqrt{2}R$
21	b	speed	
22	c	remain constant	
23	b	9000Ω	
24	d	infinite	
25	a	zero	
26	b	oersted	
27	c	$E = 0$ & $B \neq 0$	
28	d	r – rays	

Additional Short Questions

1. What is magnetic induction? Also define its unit.

Ans. The force acting on 1m long conductor placed at right angle to the magnetic field when 1A current is passing through it is known as strength of magnetic field or magnetic induction.

S.1 unit of magnetic induction is tesla (T).

$$F = ILB$$

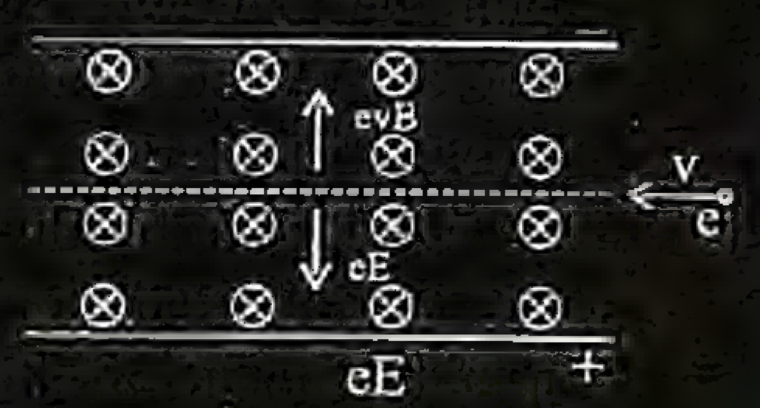
$$B = \frac{F}{IL}$$

$$1T = \frac{1N}{(1A)\times(1m)}$$

A magnetic field is said to have a strength of 1T if it exerts a force of 1N on 1m long conductor placed at right angles to the field when a current of 1A passes through the conductor.

2. Explain particle velocity selector method?

Ans. In fig direction of magnetic field is inward. The electric field E is applied perpendicular to magnetic field B. When electron enter in the region of two fields then magnetic force tends to move it in upward direction and electric force tend to move it in downward direction. When magnitude of magnetic force and electric force are equal then electron moves in a straight path undeflected.



$$F_m = qvB \sin 90^\circ$$
$$F_m = qvB$$

For electron, (q=e)

$\Rightarrow \quad F_m = evB$

For electron, (q=e)

$\Rightarrow \quad F_e = qE$

Since $\quad F_e = eE$

$$F_m = F_e$$
$$evB = eE$$
$$vB = E$$
$$v = \frac{E}{B}$$

From this equation velocity of electron can be calculated.

3. The earth's magnetic field do not affect the working of galvanometer. Why?

Ans. The earth's magnetic field is weak. The magnetic field in which coil is suspended is very strong. So the earth's magnetic field do not affect the working of moving coil galvanometer.

4. What will you do if you want to save a sensitive instrument from a magnetic field?

Ans. The instrument should be enclosed inside a hollow conductor of soft iron, since there cannot be any magnetic lines of force inside the conductor.

5. What is meant by the term electromagnetism?

Ans. The branch of physics which deals with the study of magnetic effects of current is called electromagnetism. It is concerned with the instruments in which magnetic field of current plays a vital role like galvenometer, electric motors etc.

6. **What is the shape of magnetic field lines due to straight current carrying conductor?**

Ans. The magnetic field lines due to straight carrying conductor are circular whose direction depends upon the direction of current which can be determine by using the right hand rule. (Rwp 2003)

7. **How can we determine the direction of magnetic field due to straight current carrying conductor?**

Ans. We can determine the direction of magnetic field by right hand rule. Grasp the wire in your right hand in such a way so that the erect thumb is along the direction of current then curled fingers represent the direction of magnetic field.

8. **What is the cause to exert the magnetic force on a current carrying conductor placed in uniform magnetic field?**

Ans. The magnetic force exerted on a current carrying conductor is the result of interaction of two magnetic fields i.e.

(i) Field due to current carrying conductor (circular field likes)

(ii) Externally applied magnetic field.

9. **Name the factors on which the magnetic force on the current carrying conductor depends?**

Ans. Magnetic force on current carrying conductor depends upon the following factors:

(i) Magnetic force is directly proportional to length of the conductor. (i.e. $F \propto L$)

(ii) Magnetic force is directly proportional to externally applied magnetic field. (i.e. $F \propto B$)

(iii) Magnetic force is directly proportional to current through the conductor (i.e. $F \propto I$)

(iv) Magnetic force is directly proportional to Sin α (i.e. $F \propto \sin\alpha$)
Where 'α' is the angle between length of conductor and the magnetic field.

9. **Will the two straight current carrying conductors attracts or repel each other if the direction of current be (i) same (ii) opposite?**

Ans. (i) Two straight current carrying conductors having to same direction of current will attract each other.

(ii) Two straight current carrying conductors having opposite direction of current will repel each other.

11. **Can an electron at rest be set in motion with a magnet?**

Ans. No, an electron at rest cannot be set in motion with a magnet, because charge at rest experiences no force in a magnetic field.
As $F = qvB \sin\theta$, But $v = 0$ So $F = 0$ (Lhr 2006, Rwp 2006)

12. **Differentiate between magnetic flux and magnetic flux density?**

Ans. ⇒ Number of magnetic field lines passing through a certain element of area is called magnetic flux.

Mathematically, $\phi = \vec{B}.\vec{A}$

⇒ Magnetic flux per unit area of surface perpendicular to magnetic field is called magnetic flux density or magnetic field strength.

Mathematically, $B = \frac{\phi}{A}$

Its S1 unit is tesla. (Lhr 2006, Rwp 2006, Mir Pur 2006)

13. **State the amperes law?**

Ans. Amperes law can be stated as:
Sum of all the quantities $\vec{B}.\Delta\vec{\ell}$ in which the complete loop has been divided is equal to μ_o times the total current encloses

$$\sum_{r=1}^{x} B\,\Delta\theta_r = \mu_0 I$$

14. **Why we can neglect the magnetic field outside the current carrying solenoid?**

Ans. As the field lines within the solenoid are closed and equally spaced so field will be strong and uniform. While outside the solenoid field is very weak. So it can be neglected as compare to non the field inside the solenoid

15. **How can we determine the direction of magnetic field due to current carrying solenoid?**

Ans. We can determine the direction of magnetic field due to current carrying solenoid by using Right hand rule which states, hold the solenoid in the right hand with fingers curling in the direction of current, the thumb will point in the direction of north pole.

16. **Give the three possibilities that the magnetic force will not exerts on a charge particle in the magnetic field?**

Ans. As magnetic force is given by $\vec{F} = q\vec{v}\times\vec{B}$
Following are three possibilities:

(i) When charged particle is in state of rest. (i.e. $v = 0$)

(ii) When charged particle moves parallel to magnetic field. (i.e. $\theta = 0^\circ$)

(iii) When charged particle moves anti parallel to magnetic field. (i.e. $\theta = 180^\circ$)

17. **What is Lorentz force? Give its mathematical form?**

Ans. The combined effect of electric force and magnetic force exerted on changed palsied is called Lorentz force.

Mathematically $\vec{F} = \vec{F}_e + \vec{F}_B$

Or $\vec{F} = q\vec{E} + q(\vec{v} \times \vec{B})$ (Lhr 2006-2008)

18. **State the principle to determine the charge to mass ratio of an electron?**

Ans. When electron enters perpendicularly in a uniform magnetic field then magnetic force provides the necessary centripetal force and deflect it into a circular path. (i.e. $F_m = F_c$). That is the principle to determine the charge to mass ratio of an electron.

19. **Find the radius of the orbit of an electron moving with a velocity of 2×10^7 ms^{-1} in a field of 1.20×10^{-3}T.**

Ans. As $\frac{e}{m} = \frac{V}{Br}$

or $r = \frac{Vm}{eB} = \frac{2\times10^7 \times 9.1\times10^{-31}}{1.6\times10^{-19}\times1.2\times10^{-3}} = 9.43 \times 10^{-2}$m

20. **Name the main parts of CRO?**

Ans. Following are the main parts of CRO:

(1) Filament F which is used for the emission of electrons.
(2) Cathode C which is heated directly by F.
(3) Grid G which is used for brightness control of the graph.
(4) Anodes A_1, A_2, A_3 which are used for focusing and accelerating electrons.
(5) Horizontal deflecting plates XX
(6) Vertical deflecting plates YY
(7) Fluorescent screen.

21. **What is sweep or time base generator in an oscilloscope?**

Ans. Time base generator provide the saw tooth wave signal across the horizontal deflecting plates in which potential on one plate increases with 6me and the rapidly falls to zero this causes to form the horizontal straight line on the screen of CRO.

22. **How the wave form shown on the screen of the CRO can make stationary?**

Ans. When the frequency of signal from time base generator synchronize with the frequency of input signal across vertical deflecting plates they graph of the signal become stationary on teh screen of CRO.

23. **What is CRO? Give some important uses of CRO?**

Ans. A high speed graph plotting device is called cathode ray oscilloscope (CRO).

(i) It is used to display the wave form of the signal.
(ii) It is used to determine the peak or rms value of voltage.
(iii) It is used to determine the frequency and time period of the signal.
(iv) It is used to determine the phase difference of two signals.

(Grw 2006-2008)

24. **How the torque is produced in current carrying rectangular coil?**

Ans. When a current carrying rectangular coil is placed in uniform magnetic field then equal and apposite force acts on sides of rectangular coil which are perpendicular to the field and form a couple, which tends to rotate the coil about its axis and torque is produced.

τ = NIAB cos α (D.G.Khan 2006)

25. **What is galvanometer, give its working principle?**

Ans. Galvanometer is an electrical device, used to detect the passage of current through the coil.

According to its working principle, when a current carrying conductor is placed in a magnetic field then it experience a force when current passes through it. Due to this force a torque acts upon the conductor, if it is in the form of coil given by

τ = NIAB cos α

26. **Name the two methods to measure the deflection in the galvanometer?**

Ans. The two methods used to measure the deflection on the galvanometer are

(i) Lamp and scale arrangement (suspended coil galvanometer)
(ii) Pivated coil galvanometer

27. **Differentiate between suspended (ballistic) and pivoted (weston type) galvanometer?**

Ans. In case of suspended coil galvanometer, no fixed axis (pivot) would pass through the frame of coil while in case of pivoted coil galvanometer a pivot must pass through the frame of rectangular coil.

28. **How can we increase the sensitivity of the galvanometer?**

Ans. As we know that

$$I = \left(\frac{c}{BNA}\right)\theta$$

So in order to increase the sensitivity the factor $\frac{c}{BNA}$ must be very small. By increasing B which can be made by placing the iron core inside the coil, the increase in sensitivity is the most effective method. (Bwp 2003)

29. **State the current sensitivity for a suspended coil galvanometer.**

Ans. We define the current sensitivity of the galvanometer as the current in microamperes required to produce one millimeter deflection on the scale placed one meter away from mirror of galvanometer.

30. **What is meant by meter movement?**

Ans. The portion of galvanometer whose motion causes the needle of the device to move across the scale is usually known as meter movement.

31. **How the galvanometer is converted into an ammeter and into a voltmeter?**

Ans. ⇒ In order to convert a galvanometer in an ammeter a very low resistance should be connected in parallel across the galvanometer.

⇒ In order to convert a galvanometer in a voltmeter a high resistance should be connected in series across the galvanometer.

32. **What is stable or dead beat galvanometer?**

Ans. Such a galvanometer in which the coil comes to rest quickly after the current passes through it or the current is stopped from flowing through it is called stable or dead beat galvanometer. **(Federal 2006, Grw 2008, Lhr 2009)**

33. **Define torsional couple.**

Ans. A couple necessary to produce unit twist in the coil is called torsional couple.

34. **How can we increase the range of an ammeter and a voltmeter?**

Ans. (i) By decreasing the value of resistance connected a parallel in ammeter we can increase the range of ammeter.

(ii) By increasing the value of resistance connected in series in voltmeter we can increase the range of voltmeter.

35. **What is AVO meter?**

Ans. AVO stands for Ampere Volt and Ohm. So it is a multipurpose instrument used to measure the current, potential difference as well as resistance.

36. **What is digital multi-meter, give its advantages over the analog multi-meter?**

Ans. It is an electronical device which is used to measure current, resistance and voltage in a circuit.

The advantages of digital multi-meter are:

(i) It is very much accurate

(ii) It is easy to operate because it eliminate the human error.

(iii) It is portable due to its small size.

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. **A voltmeter is always connected in**
(a) parallel (b) series (c) perpendicular (d) straight line

2. **One tesla is equal to**
(a) $NA^{-1}m$ (b) NA^{-1} (c) Nm^{-1} (d) $NA^{-1}m^{-1}$

3. **Magnetic force on a moving charged particle is perpendicular to the ________**
(a) Magnetic field (b) Electric field
(c) Velocity of the particle (d) Magnetic field and velocity of the particle

4. **Resistance of a voltmeter should be ________ as compared to the resistance across which it is connected.**
(a) High (b) Very high (c) Low (d) Very low

5. **The anode in the cathode ray oscilloscope:**
(a) Control number of waves (b) Control the brightness of spot formed
(c) Accelerates and focus beam (d) At negative potential with respect to cathode

6. **The relation for maximum value of deflecting couple is given by:**
(a) $\tau = B/NIA$ (b) $\tau = BINA$ (c) $\tau = BNA$ (d) $\tau = BNA \sin\alpha$

7. **The brightness of spot on CRO screen is controlled by:**
(a) Anodes (b) Cathodes (c) Grid (d) Plates

8. **Magnetic field $(4\hat{i}+18\hat{k})\,Wbm^{-2}$ passes through $(5\hat{k})\,m^2$ area. Net flux through the area is**
(a) 20 Wb (b) 90×10^{-4} Wb (c) 90 Wb (d) zero

9. **A current carrying coil placed in uniform magnetic field experiences maximum torque when angle between plane of coil and magnetic field is**
(a) 0° (b) 45° (c) 60° (d) 90°

10. **Shunt resistance is called**
(a) Bypass resistor (b) specific resistor (c) reactance (d) impedance

11. A charge particle moving in a magnetic field experiences a magnetic force given by
(a) $\vec{F_m} = q(\vec{v}\times\vec{B})$ (b) $\vec{F_m} = q(\vec{v}.\vec{B})$
(c) $\vec{F_m} = (\vec{v}\times\vec{B})/q$ (d) $\vec{F_m} = (\vec{v}.\vec{B})/q$

12. A moving proton develops in a surrounding space
(a) electric field (b) magnetic field
(c) electromagnetic force (d) none of these

13. A charged body is projected at an angle into the uniform magnetic field. Which is of the following parameters of the charged particle will be effected by the magnetic field
(a) energy (b) momentum (c) speed (d) all of these

14. The magnetic field inside a current carrying long solenoid is
(a) non-uniform (b) weak (c) uniform and steady (d) zero

15. If current flows from top towards bottom through a wire then direction of lines of force is
(a) parallel to wire (b) perpendicular to wire
(c) clockwise (d) anti-clockwise

16. Magnetic field inside the turns of a toroid of radius r and total N turns carrying current I is given by
(a) $\mu_o \dfrac{2\pi r}{NI}$ (b) $\dfrac{N\mu_o I}{2\pi r}$ (c) $\dfrac{2\pi r}{\mu_o NI}$ (d) $\mu_o NIr$

17. The brightness of the spot on CRO screen is controlled by
(a) cathode (b) anode (c) grid (d) plates

18. A magnetic field acts on a charged particle so as to change its
(a) speed (b) energy (c) direction of motion (d) all of these

19. The sensitivity of galvanometer can be increased by
(a) decreasing the area of coil (b) decreasing the number of turns of coil
(c) increasing the magnetic field (d) using a fine suspension

20. The mathematical expression $\sum_{i=1}^{n}(B.\Delta l)_i = \mu_o I$ is known as
(a) Lenz's law (b) Ampere's law (c) Gauss's law (d) Faraday's law

21. To measure the current in a circuit, ammeter is always connected in
(a) parallel (b) series
(c) either parallel or series (d) neither parallel nor series

22. An instrument that gives a pointer deflection proportional to the current through itself is called
(a) voltmeter (b) galvanometer
(c) wattmeter (d) potentiometer

23. The magnetic force is simply a
(a) reflecting force (b) deflecting force
(c) restoring force (d) gravitational force

24. An avometer can also be called as
(a) digital ammeter (b) digital CRO (c) digital voltmeter (d) multimeter

Answers Key:

1.	(a) parallel	13.	(b) momentum
2.	(d) $NA^{-1}m^{-1}$	14.	(c) uniform and steady
3.	(d) Magnetic field and velocity of the particle	15.	(c) clockwise
4.	(b) Very high	16.	(b) $\dfrac{N\mu_o I}{2\pi r}$
5.	(c) Accelerates and focus beam	17.	(c) grid
6.	(b) $\tau = BINA$	18.	(c) direction of motion
7.	(c) Grid	19.	(d) using a fine suspension
8.	(c) 90 Wb	20.	(b) Ampere's law
9.	(a) 0°	21.	(b) series
10.	(a) Bypass resistor	22.	(b) galvanometer
11.	(a) $\vec{F_m} = q(\vec{v}\times\vec{B})$	23.	(b) deflecting force
12.	(b) magnetic field	24.	(d) multimeter

Chapter 15 ELECTROMAGNETIC INDUCTION

Topic Wise MCQ's

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer.

Induced EMF And Induced Current, Motional EMF

1. It is the converse process of magnetic effect of current.
   (a) x-ray production (b) photoelectric effect
   (c) Laser production (d) electromagnetic induction
2. The fact that emf produced by motion of a coil across a magnetic field was discovered by
   (a) Henry (b) Coulomb
   (c) Oersted (d) Henry and Michael Faraday
3. If the length of a conductor placed parallel to magnetic field is doubled, the induced emf
   (a) becomes double (b) reduces to half
   (c) zero (d) remains constant
4. In motional emf experiment, when the system reaches an equilibrium state,
   (a) $B = vE_o$ (b) $E_o = vB$
   (c) $B/E_o = v$ (d) $qvB = mg$
5. The phenomena by which an induced emf is produced due to change of flux is called
   (a) electromagnetic induction (b) electrostatic induction
   (c) electromagnetism (d) none of these
6. A loop of wire is placed perpendicular to a uniform magnetic field of strength 0.6 T. If the area of loop shrinks at a constant rate of $0.8m^2/s$,then the emf induced in the loop while shrinking is
   (a) 48V (b) 0.48V

(c) 4.8V (d) 0.048V

7. Induced current always acts to ______ the magnetic flux through the circuit.
(a) decrease (b) increase
(c) oppose (d) remain same

8. The motional emf in a conductor can be increased by
(a) using a strong magnetic field
(b) moving the conductor parallel to field
(c) decreasing the length of conductor
(d) both a and b

9. The value of the induced emf in a loop of wire is directly proportional to the rate of change of ________ through the loop
(a) electric flux (b) magnetic flux
(c) both (a) and (b) (d) current

10. The phenomenon of induced emf was observed by Faraday and Henry in
(a) 1631 (b) 1731
(c) 1831 (d) 1931

11. Motional emf does not depend upon
(a) speed of conductor (b) resistance of conductor
(c) magnetic field strength (d) none of these

12. An induced emf is produced in a circuit when
(a) magnetic flux remain constant
(b) magnetic flux change
(c) no magnetic flux produced
(d). none of these

13. Current can be induced in a coil by changing the area of the coil in a
(a) constant magnetic field (b) constant electric field
(c) magnetic field parallel to plane of coil (d) none of these

14. The induced emf lasts so long as the magnetic flux keeps
(a) constant (b) changing
(c) either of these (d) none of these

15. The emf induced by the motion of a conductor across a magnetic field is called
(a) back emf (b) induced emf

(c) motional emf (d) both b and c

16. The motional emf of a conductor of length L and moving perpendicular to a magnetic field B is equal to
(a) zero (b) qvB
(c) vBL (d) vBL sin θ

17. The motional emf depends upon the
(a) length of the conductor (b) speed of the conductor
(c) strength of magnetic field (d) all of these

18. If a conductor is placed perpendicular to a magnetic field B is then motional emf will be
(a) maximum (b) -vBL
(c) both a and b (d) zero

19. If a conductor of length 1m is moved with velocity v across a magnetic field B at an angle of 30° with B ,then motional emf will be
(a) 1/2 vB (b) 1/2 vBL
(c) 0.866vBL (d) none of these

20. If a conductor of unit length is moving in a magnetic field of 1 tesla at 30° with velocity 1 ms^{-1}, then induced emf in the rod will be
(a) 0.5 V (b) 0.55 V
(c) 0.707 V (d) 1.0 V

21. Faraday's law is based upon law of conservation of
(a) mass (b) energy
(c) charge (d) none of these

22. The motional emf ,when the conductor is moved opposite to magnetic filed, is
(a negative (b) -vBL
c) both a and b (d) zero

FARADAY'S Law and Induced EMF, LENZ'S Law and Direction Of Induced EMF

23. $\frac{\Delta\phi}{\Delta t}$ has the same units as that of
(a) magnetic induction (b) current
(c) charge (d) emf

24. Faraday's law is given by
(a) $\varepsilon = -L\frac{\Delta t}{\Delta\phi}$ (b) $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$
(c) $\varepsilon = -\frac{\Delta\phi}{N\Delta t}$ (d) $\varepsilon = -L\frac{\Delta\phi}{\Delta t}$

25. "The direction of induced current is always so as to oppose the change which causes the current." This is the statement of

(a) Faraday's law (b) Ampere's law
(c) Lenz's law (d) Gauss's law

26. Lenz's law is in accordance with the law of conservation of
(a) charge (b) energy
(c) momentum (d) angular momentum

27. The current flowing through a coil due to induced emf in it, depends upon:
(a) area of the coil (b) resistance of the coil
(c) shape of the coil (d) all of these

28. The direction of the induced current in a certain coil can easily be found by using
(a) right hand rule (b) Ampere's law
(c) Faraday's law (d) Lenz's law

29. Lenz's law deals directly with the
(a) direction of induced emf (b) direction of induced current
(c) magnitude of induced emf
(d) both direction and magnitude of emf

30. The negative sign with induced emf in Faraday's law is in accordance with
(a) Lenz's law (b) Ampere's law
(c) Gauss's law (d) none of these

31. Heinrich Lenz's gave Lenz's law in
(a) 1734 (b) 1834
(c) 1934 (d) 1943

32. A metallic ring is attached to wall of a room. When the north pole of a bar magnet is brought near the ring, the induced current in the ring is
(a) in clockwise direction (b) zero
(c) in anti-clockwise direction (d) infinite

33. The induced emf primarily produced at the cost of
(a) electrical energy (b) chemical energy
(c) mechanical energy (d) internal energy

Mutual Induction, Self Induction

34. The phenomenon in which a changing current in one coil induces an emf in nearby coil is called
(a) self induction (b) mutual induction
(c) electrostatic induction (d) both a and b

35. In mutual induction, the coil placed with source of electric energy is called
(a) primary coil (b) secondary coil
(c) resistance (d) choke

36. The coil used to obtain the output by mutual induction phenomenon is known as
(a) primary coil (b) secondary coil
(c) resistance (d) none of these

37. The mutual inductance of two coils is given by the relation
(a) $M = -\frac{\varepsilon_s}{\Delta t/\Delta I_p}$ (b) $M = -\frac{\varepsilon_s}{\Delta I_p/\Delta t}$
(c) $M = -\frac{\varepsilon_s}{\Delta I_p \Delta t}$ (d) $M = -\frac{\varepsilon_s}{\Delta I_p}$

38. The mutual inductance of coils depends upon
(a) number of turns of the coils
(b) the area of cross-section of the coils
(c) distance between the coils
(d) all of these

39. Which one of the following expressions for mutual inductance is correct?
(a) $M = \frac{N_s\phi_s}{I_p}$ (b) $M = \frac{\phi_s}{N_s I_p}$
(c) $M = \frac{I_p}{N_s\phi_s}$ (d) $M = \frac{N_s}{I_p\phi_s}$

40. Mutual inductance has a practical role in the performance of the
(a) radio choke (b) A.C. generator
(c) D.C. generator (d) transformer

41. The ratio of the emf induced in the secondary coil to the rate of change of current in the primary coil is known as
(a) mutual induction (b) mutual inductance
(c) self-induction (d) self inductance

42. Mutual inductance is basically the
(a) emf (b) current
(c) force (d) none of these

43. weber / ampere is the unit of [Hint: $M = \frac{N_s\phi_s}{I_p}$]
(a) mutual induction (b) self-induction
(c) mutual inductance (d) none

44. SI unit of mutual inductance is
(a) volt/ampere (b) ampere

(c) tesla (d) henry

45. One henry is equal to

(a) $Vs^{-1}A$ (b) NmA^{-1}

(c) VsA^{-1} (d) $V^{-1}sA$

46. 1 VsA^{-1} = ________

(a) 1 T (b) 1 Wb/A

(c) 1 Nm/A (d) 1 V/A

47. In self induction phenomenon, the total flux through the coil is directly proportional to the ________ through the coil

(a) magnetic field (b) current

(c) both a and b (d) none of these

48. If the coil is wound on an iron core, the flux through it will

(a) Increase (b) decrease

(c) remain constant (d) be zero

49. The phenomenon in which changing current in a coil induces an emf in itself is called:

(a) mutual induction (b) self induction

(c) mutual inductance (d) self inductance

50. The ratio of average emf in the coil to the time rate of change of current in the same coil is called

(a) mutual induction (b) mutual inductance

(c) self induction (d) self inductance

51. If a steady current is passing though a coil ,then the self induced emf in it will be

(a) zero (b) maximum

(c) negative (d) $\varepsilon = -L\frac{\Delta I}{\Delta t}$

52. The self-inductance of the coil is given by

(a) $L = -\varepsilon_L\frac{\Delta I}{\Delta t}$ (b) $L = -\varepsilon_L\frac{\Delta t}{\Delta I}$

(c) $L = -\frac{\varepsilon_L}{\Delta I/\Delta t}$ (d) $L = -\frac{\Delta I/\Delta t}{\varepsilon_L}$

53. The SI unit of self-inductance is

(a) tesla (b) volt

(c) ampere (d) henry

54. The mathematical expression for self-inductance of coil is given by

(a) $NL = \phi I$ (b) $NI = L\phi$

(c) $L = N\phi/I$ (d) $N = LI/\phi$

55. The self inductance of the coil depends upon

(a) number of turns of coil (b) area of cross-section

(c) core material (d) all of these

56. Self-induced emf is also called

(a) back emf (b) motional emf

(c) variable emf (d) all of these

57. Self-inducting coils are also called

(a) insulators (b) capacitors

(c) inductors (d) semi-conductors

58. In alternating current, inductors behaves like

(a) capacitors (b) thermistors

(c) resistors (d) none of these

59. The inductance in a coil plays the same role in AC circuits as in ____ play in mechanics

(a) mass (b) torque

(c) force (d) none of these

Energy Stored In An Inductor, Alternating Current Generator

60. An inductor may store energy in

(a) its electric field (b) its magnetic field

(c) its coil (d) both a and b

61. If N is the number of turns in a coil, the value of self-inductance varies as

(a) N^{-2} (b) N^2

(c) N (d) N^0

62. Self inductance (L) of a coil is

(a) $\mu_o n^2 l$ (b) $\mu_o N^2 A l$

(c) $\mu_o n^2 A l$ (d) $\mu_o n A l^2$

63. If the number of turns and the length of an inductor is doubled, the inductance(L) becomes

(a) 4L (b) 8L

(c) 2L (d) L

64. The energy stored in an inductor is given by

(a) LI^2 (b) $\frac{L^2I}{2}$

(c) $\frac{LI^2}{2}$ (d) IL^2

65. When a motor car is started its head light first becomes slight dim because the voltage across the lamp
[Hint: due to change of current emf is induced in the filament of lamp which opposes the applied voltage]
(a) increases (b) decreases
(c) remains same (d) first a then b

66. Energy stored per unit volume inside the solenoid is called
(a) energy density (b) charge density
(c) mass density (d) volume charge density

67. The self inductance of a coil ______ when a soft iron is placed into it.
(a) decreases (b) increases
(c) first increases then decreases (d) remains same

68. A device which converts mechanical energy into electrical energy is called
(a) motor (b) inductor
(c) electric generator (d) transformer

69. The most common source of an A.C. voltage is
(a) motor (b) generator
(c) cell (d) transformer

70. The principle of an electric generator is based on
(a) Coulomb's law (b) Ampere's law
(c) Faraday's law (d) Lenz's law

71. The working of A.C. generator is based upon the phenomenon of
(a) mutual induction (b) self induction
(c) electromagnetic induction (d) all of these

72. Which of the following is not present in A.C. generator?
(a) armature (b) magnet
(c) slip-rings (d) commutator

73. If the plane of A.C. generator coil is parallel to the field, then emf induced (or current) in coil is

(a) maximum (b) minimum
(c) half of its maximum value (d) zero

74. If the plane of A.C. generator coil is perpendicular to the field, then emf induced (or current) in coil is
(a) maximum (b) minimum
(c) half of its maximum value (d) zero

75. A.C. can be measured by its
(a) heating effect (b) magnetic effect
(c) chemical effect (d) all of these

76. A.C current reverses its direction
(a) T times / sec (b) f times /sec
(c) once/cycle (d) both b and c

77. Alternating emf is produced by rotating a rectangular coil of wire in
(a) electric field (b) magnetic field
(c) gravitational field (d) nuclear field

78. In case of alternating current, the average value of current and voltage is
(a) less than zero (b) greater than zero
(c) zero (d) 1

79. If peak value of emf is V, then angular velocity of the coil of alternating generator is
(a) V/BAN (b) BAN / V
(c) NABsinθ (d) Both a and c

80. The maximum emf produced by an alternating generator is
(a) $N\omega AB \sin\theta$ (b) $N\omega AB \cos\theta$
(c) $N\omega AB$ (d) none of these

81. The emf induced in the coil of A.C. generator will be maximum when the angle between the plane of coil and the magnetic field is
(a) 0° (b) 90°
(c) 45° (d) 30°

82. Alternating current generator uses
(a) split rings (b) slip rings
(c) Commutator (d) both b and c

83. Working of generator based upon
(a) Faraday's law of electrostatic (b) Ampere's law

induction

(c) Faraday's law of electromagnetic inducti (d) Gauss's law

84. The induced emf in a rotating coil of A.C. generator varies with time
(a) sinusoidally (b) linearly
(c) exponentially (d) none of these

85. An alternating current is that, which
(a) remains constant (b) varies in magnitude
(c) reverses its periodically (d) both b and c

86. Frequency of A.C. used in Pakistan is
(a) 50 Hz (b) 100 Hz
(c) 120 Hz (d) 220 Hz

87. The working of electric motor is reversed of
(a). Transformer (b) Generator
(c) Electric fan (d) All of these

88. The number of coils wound around an iron cylinder and rotated in magnetic field is called
(a) turbine (b) commutator
(c) an armature (d) transformer

89. The device in the circuit that consumes electrical energy is called
(a) capacitor (b) inductor
(c) generator (d) load

D.C. Generator, Back Motor Effect In Generator, D.C. Motor, Back EMF Effect In Motor

90. The only difference between construction of D.C. generator and an A.C. generator is that of
(a) carbon brushes (b) armature
(c) commutator (d) magnetic field

91. A.C. and D.C. have the same
(a) effect in charging capacitor
(b) effect in charging battery
(c) heating effect through a resistance
(d) all of these

92. The fluctuations in the out put of D.C. generator can be reduced by
(a) multiple coils connected to a single commutator
(b) tapping the output only as it reaches its peak emf
(c) multiple coils connected to a separate commutator
(d) both b and c

93. The component mainly used in a D.C. generator is
(a) slip rings (b) split rings (commutator)
(c) electromagnet (d) vibrator

94. back motor effect in generators is in accordance with law of conservation of
(a) mass (b) charge
(c) momentum (d) energy

95. Commutator was invented in
(a) 1734 (b) 1834
(c) 1934 (d) 1943

96. Commutator was invented by
(a) Michael Faraday (b) Joseph Henry
(c) William Sturgeon (d) Hans Oersted

97. The brushes used in generator are made of
(a) steel (b) iron
(c) copper (d) carbon

98. The emf in the outer circuit of D.C. generator is
(a) alternating (b) constant
(c) zero (d) none of these

99. The fluctuations of the output of generator can be reduced by
(a) using commutator (b) using slip ring
(c) using many coils (d) using many resistors

100. In D.C. generator, output of every coil is tapped only as it reaches its
(a) peak value (b) least value
(c) intermediate value (d) none of these

101. When current flows through the armature coil, the force on the conductor produces
(a) heat (b) light
(c) torque (d) none of these

102. The amount of torque in D.C. motors depends upon

(a) current (b) strength of magnetic field
(c) area and number of turns of the coil
(d) all of these

103. A generator running in reverse may be called as
(a) transformer (b) motor
(c) galvanometer (d) rectifier

104. A motor is a device which converts electrical energy into
(a) heat energy (b) light energy
(c) chemical energy (d) mechanical energy

105. Which one of the following can produce maximum induced emf?
(a) 50A DC (b) 50A, 50Hz AC
(c) 50A 500Hz AC (d) 100 A DC

106. The induced emf in a motor which opposes the applied emf running the motor is called
(a) static emf (b) back emf
(c) motional emf (d) all of these

107. If back emf in a motor decreases, then it will draw
(a) more current (b) small current
(c) no current (d) infinite current

108. When motor is started, the back emf is
(a) very large (b) zero
(c) almost zero (d) constant

109. When a motor is over loaded, then the magnitude of back emf
(a) increases (b) decreases
(c) remains constant (d) becomes zero

110. A motor of zero back emf draws________ current.
(a) maximum (b) minimum
(c) constant (d) no

111. The back emf of a motor can be expressed as
(a) $\varepsilon = V + IR$ (b) $\varepsilon = \frac{V + IR}{V}$
(c) $\varepsilon = \frac{V + IR}{R}$ (d) $\varepsilon = V - IR$

Transformer

112. The device which is used to increase or decrease the value of alternating voltage is called
(a) A.C. generator (b) D.C. generator
(c) transformer (d) electric motor

113. In transformer works on the principle of
(a) self induction (b) mutual induction
(c) electrostatic induction (d) none of these

114. In transformer which one of the following does not change
(a) voltage (b) current
(c) both a and b (d) frequency

115. A transformer is used to stp up or step down
(a) D.C. voltage (b) mechanical energy
(c) A.C. voltage (d) both b and c

116. Turns ratio (r) for a step down transformer is
(a) $r = 0$ (b) $r = 1$
(c) $r > 1$ (d) $r < 1$

117. A transformer
(a) transform energy (b) generates emf
(c) transform frequency (d) transforms voltage

118. A transformer functions with
(a) A.C. only (b) D.C. only
(c) both (a) and (b) (d) electric motor

119. A transformer is used to
(a) convert A.C. into D.C. (b) change A.C. level
(c) convert D.C. into A.C. (d) change D.C. level

120. Transformer makes possible the
(a) transmission of A.C. power (b) transmission of D.C. power
(c) both (a) and (b) (d) none of these

121. In step up transformer
(a) $N_1 < N_2$ (b) $N_1 > N_2$
(c) $N_1 = N_2$ (d) none of these

122. In step down transformer

(a) $N_s < N_p$ (b) $N_s > N_p$
(c) $N_s = N_p$ (d) none of these

123. The core of transformer is made of
(a) steel (b) soft iron
(c) copper (d) all of these

124. For an ideal transformer
(a) power input > power output
(b) power input < power output
(c) power input ≈ power output
(d) none of these

125. The turns ratio of a transformer is 10. It means that
(a) $I_p = 10I_s$ (b) $N_s = N_p/10$
(c) $N_s = 10N_p$ (d) both a and c

126. The main causes of power losses in a transformer are
(a) eddy currents (b) magnetic hysterisis
(c) both (a) and (b) (d) none of these

127. By placing soft iron inside a coil
(a) increases the magnetic flux
(b) decreases the magnetic flux
(c) creates no change in magnetic flux
(d) none of these

128. The induced currents setup in the core of transformer in a direction perpendicular to the flux are known as:
(a) steady currents (b) variable currents
(c) eddy currents (d) none of these

129. Electricity can be transmitted over long distances by
(a) Increasing I (b) decreasing V
(c) decreasing I (d) all of these

130. A transformer steps down 220 V to 40 voltage. If the secondary turns are 40 then number of primary turns are
(a) 20 (b) 40
(c) 120 (d) 220

131. In a step up transformer the current in the secondary windings is

(a) less than current in primary (b) more than current in primary
(c) equal to current in primary (d) Of same polarity as in the primary

132. The loss of energy over an A.C. cycle during the magnetization and demagnetization of transformer core is usually called
(a) magnetization loss (b) demagnetization loss
(c) hysterisis loss (d) all of these

133. The loss of power in transformer can be reduced by
(a) using the laminated sheets of a material
(b) decreasing the resistance of the coils
(c) proper coupling of primary and secondary coils
(d) all of these

134. Transformer for domestic use step down the voltage to
(a) 600 volts (b) 220 volts
(c) 400 volts (d) 120 volts

Answer Key's

1.	(d) electromagnetic induction	2.	(d) Henry and Michael Faraday
3.	(c) zero	4.	(b) $E_o = vB$
5.	(a) electromagnetic induction	6.	(b) 0.48V
7.	(c) oppose	8.	(a) using a strong magnetic field
9.	(b) magnetic flux	10.	(c) 1831
11.	(b) resistance of conductor	12.	(b) magnetic flux change
13.	(a) constant magnetic field	14.	(b) changing
15.	(c) motional emf	16.	(c) vBL
17.	(d) all of these	18.	(a) maximum
19.	(a) ½ v/B	20.	(a) 0.5V
21.	(b) energy	22.	(d) zero
23.	(d) emf	24.	(b) $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$
25.	(c) Lenz's law	26.	(b) energy

27.	(b) resistance of the coil	28.	(d) Lenz's law
29.	(b) direction of induced current	30.	(a) Lenz's law
31.	(b) 1834	32.	(c) in anti-clockwise direction
33.	(c) mechanical energy	34.	(b) mutual induction
35.	(a)	36.	(b) secondary coil
37.	(b) $M = -\frac{\varepsilon_s}{\Delta I_p/\Delta t}$	38.	(d) all of these
39.	(a) $M = \frac{N_s\phi_s}{I_p}$	40.	(d) ransformer
41.	(b) mutual inductance	42.	(a) emf
43.	(c) mutual inductance	44.	(d) Henry
45.	(c) VsA^{-1}	46.	(b) 1 Wb/A
47.	(b) current	48.	(a) increase
49.	(b) self induction	50.	(c) self induction
51.	(a) zero	52.	(b) $L = -\varepsilon_L\frac{\Delta t}{\Delta I}$
53.	(d) Henry	54.	(c) $L = N\phi/I$
55.	(d) all of these	56.	(a) back emf
57.	(c) inductors	58.	(c) resistors
59.	(a) mass	60.	(b) its magnetic field
61.	(b) N^2	62.	(c) $\mu_o n^2 Al$
63.	(c) 2L	64.	(c) $\frac{LI^2}{2}$
65.	(b) decreases	66.	(a) energy density
67.	(b) increases	68.	(c) electric generator
69.	(b) generator	70.	(c) Faraday's law
71.	(c) electromagnetic induction	72.	(d) commutator
73.	(a) maximum	74.	(d) zero
75.	(a)	76.	(c)
77.	(b) magnetic field	78.	(c) zero
79.	(a) V/BAN	80.	(c) NωAB

81.	(b) 90°	82.	(b) slip rings
83.	(c) Faraday's law of electromagnetic inducti	84.	(a) sinusoidally
85.	(d) both b and c	86.	(a) 50 Hz
87.	(b) generator	88.	(c) an armature
89.	(d) load	90.	(c) commutator
91.	(c) heating effect through a resistance	92.	(d) both b and c
93.	(b) split rings (commutator)	94.	(d) energy
95.	(b) 1834	96.	(c) William Sturgeon
97.	(d) carbon	98.	(b) constant
99.	(c) using many coils	100.	(a) peak value
101.	(c) torque	102.	(d) all of these
103.	(b) motor	104.	(d) mechanical energy
105.	(c) 50A 500Hz AC	106.	(b) back emf
107.	(a) more current	108.	(c) almost zero
109.	(b) decreases	110.	(a) maximum
111	(d) $e = V - IR$	112.	(c) transformer
113.	(b) mutual induction	114.	(d) frequency
115.	(c) mechanical energy	116.	(c) $r > 1$
117.	(d) transforms voltage	118.	(a) A.C. only
119.	(b) change A.C. level	120.	(a) transmission of A.C. power
121.	(b) $N_s > N_p$	122.	(a) $N_s > N_p$
123.	(b) soft iron	124.	(c) power input ≈ power output
125.	(d) both a and c	126.	(c) both a and b
127.	(a) increases the magnetic flux	128.	(c) eddy current
129.	(c) decreasing I	130.	(d) 220
131.	(a) less than current in primary	132.	(c) hysterisis loss
133.	(d) all of these	134.	(b) 220 volts

Brain Teasing MCQ's (with Hints)

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer.

1. A conducting rod of length ℓ is falling with velocity V perpendicular to magnetic field B. Which of the following is potential difference between its two ends.
   (a) $\frac{Blv}{2}$ (b) $B^2l^2v^2$
   (c) 2Blv (d) Blv
2. If magnetic flux linked with a coil varies at the rate of $\frac{1Wb}{min}$. Then induced emf will be
   (a) $\frac{1}{60}$ V (b) 1V
   (c) 60V (d) 100V
3. If L and R denotes inductance and resistance, then dimensional formula for $\frac{L}{R}$ is.
   (a) $[M^0L^0T^0]$ (b) $[M^0LT^0]$
   (c) $[M^0L^0T]$ (d) $[ML^0T^0]$
4. In a step-up transformer the turn ratio of primary and secondary coil is 1:2. A cell of 1.5 V is connected across the primary coil. Which of the following will be voltage of secondary coil?
   (a) Zero (b) 0.75V
   (c) 1.5V (d) 3V
5. Which of the following quantity remain unchanged in a transformer?
   (a) Voltage (b) Current
   (c) Frequency (d) Power
6. Which of the following are the power losses in a transformer?
   (a) copper loss (b) eddy current loss
   (c) hysteresis loss (d) All of above
7. An increase in number of turns of a coil results in.
   (a) decrease in inductance L (b) increase in inductance L

   (c) no change in inductance L (d) None of above
8. Induction furnace based upon the concern of:
   (a) Joule,s heating effect (b) Thesmoelectric effect
   (c) Peltier,s effect (d) Eddy currents
9. The angular speed of rotation of the coil of A.C generator is doubled. Then induced emf will be
   (a) half (b) same
   (c) twice (d) four times
10. In electromagnetic induction, the induced emf is independent of
    (a) change of magnetic flux (b) time
    (c) number of turns of coil (d) resistance of coil
11. The turn ratio of a transformer is 10. It means that
    (a) Is = 10Ip (b) $Ns = \frac{Np}{10}$
    (c) Ns = 10Np (d) $Vs = \frac{Vp}{10}$
12. The turn ratio of step-up transformer is 4:1. If current of 4A is passing through the primary coil. Then current in secondary coil will be.
    (a) 0.25A (b) 1A
    (c) 2A (d) 8A
13. A coil having number of turns N and cross sectional area A is rotated in a uniform magnetic field B with an angular velocity w. which of the following is the maximum induced emf in it?
    (a) $\frac{NBA}{\omega}$ (b) $\frac{NBA}{\omega^2}$
    (c) $N\omega^2AB$ (d) $N\omega AB$
14. The mutual inductance of a pair of coils each of N turns, is M henry. If a current of I ampere in one of the coil is brought to zero in t seconds, The average induced emf in other coil, in volt, will be
    (a) $\frac{MI}{t}$ (b) $\frac{NMI}{t}$
    (c) $\frac{MN}{It}$ (d) $\frac{MI}{Nt}$

15. The self inductance of a coil is 5H. The current changes from 1A to 2A in 5 second through the coil. Which of the following is the value of induced emf produced in the coil?
(a) 100V (b) 10V
(c) 1V (d) 0.1V

16. The current passing through a choke coil of 5H is decreasing at the rate of $2\frac{A}{S}$.
Which of the following is the emf developed across the coil?
(a) 10V (b) 2.5V
(c) 0.4V (d) 0.1V

17. The core of dynamo is laminated because
(a) magnetic field increase
(b) magnetic saturation level in core increases
(c) residual magnetism in core decreases
(d) loss of energy in core due to eddy currents decrease

18. A solenoid of length / metre has self inductance L henry. If the number of turns are doubled, its self inductance
(a) remain same (b) becomes 2L henry
(c) becomes 4L henry (d) becomes $\frac{L}{\sqrt{2}}$ henry

19. The number of turns in a coil is increased from 10 to 100. Its self inductance becomes
(a) $\frac{1}{10}$ times (b) 10 times
(c) 25 times (d) 100 times

20. Which of the following quantity decreases in a step-up transformer?
(a) current (b) voltage
(c) frequency (d) None of above

21. Energy density of an inductor is:
(a) directly proportional to magnetic field
(b) directly proportional is square of magnetic field
(c) inversely proportional to magnetic field
(d) inversely proportional to square of magnetic field

Answer with Hints

No.	Correct Option	Answers	Hint
1	d	BlV	$\in = BlV\sin 90^\circ$
2	a	$\frac{1}{60}$ V	$\in = N\frac{\Delta\varphi}{\Delta t}$ $= 1 \times \frac{1}{60}$ V
3	c	$[M^0L^0T]$	$\frac{L}{R} = \frac{\in \Delta I / \Delta t}{\in / \Delta I}$ $\frac{L}{R} = T$
4	a	Zero	Transformer can not be operated with D.C
5	c	frequency	frequency remain same in transformer
6	d	All of above	
7	b	L increase	$L = \mu_o n^2 A l$
8	d	Eddy currents	
9	c	twice	$\in = N\omega AB$
10	d	Resistance of coil	$\in = N\frac{\Delta\varphi}{\Delta t}$
11	c	$N_S = 10N_P$	$\frac{N_S}{N_P} = 10$
12	b	1A	$\frac{I_S}{I_P} = \frac{N_P}{N_S}$
13	d	$N\omega AB$	$\in = N\omega AB\sin 90^\circ$

14	a	$\frac{MI}{t}$	$\in = M\frac{\Delta I}{\Delta t}$
15	c	1V	$\in = L\frac{\Delta I}{\Delta t}$ $= 5 \times \frac{(2-1)}{5}$ $= 1V$
16	a	10V	$\in_L = L\frac{\Delta I}{\Delta t}$ $= 5 \times 2$ $= 10V$
17	d	loss of energy in the core due to eddy currents decreases	
18	c	becomes 4L henry	$L = \mu_0 n^2 A l$ $L = \mu_0 \left(\frac{N}{\ell}\right)^2 A l$
19	d	100 times	$L = \frac{\mu_0 N^2 A}{\ell}$
20	a	Current	
21	b	directly proportional to square of magnetic field	

Additional Short Questions

1. **What are eddy currents?**

Ans. Whenever the magnetic flux linked with a sheet of metal or a block of metal, changes, an emf is induced in it. The induced current flow in closed paths in planes perpendicular to the lines of induction in the mass of metal such currents are called eddy currents.

2. **What are application of eddy currents?**

Ans. Following are application of eddy currents.
- (i) Electromagnetic damping i-e in dead beat galvanometer
- (ii) Induction furnace
- (iii) Electric brakes
- (iv) Speedometer of a car

3. **What is physical significance of self inductance?**

Ans. The self inductance is called the electrical inertia of the coil or circuit just as mass is a measure of inertia in mechanical motion. If inductance is large, The induced emf is high and greater is the opposition to the change in current. To overcome this inertia the coil should be connected to an external voltage source.

4. **State Faraday's law of electromagnetic induction.**

Ans. Faraday's law can be stated as

"The average value of induced emf is equal to the negative rate of change of magnetic flux with respect to time".

Mathematically: $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ **(Mtn 2006, Rwp 2007, D.G.Khan 2007)**

5. **State Lenz's law?**

Ans. The Lenz's law can be stated as,

"The direction of the induced current is always such that it opposes the change which cause the current."

(Rwp 2005, Grw 2005, Sgd 2005, Mtn 2006, Lhr 2006)

6. **Explain briefly principle of Generator?**

Ans. The working principle of generator is Faraday's law of electromagnetic induction. According to which

"The average value of induced emf is equal to the negative rate of change of magnetic flux with respect to time.

Mathematically: $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$

7. **Why self-induced emf is also called back emf?**

Ans. As self-induced emf must oppose the change that produce it. That is why self-induced emf is also referred as back emf. This is exactly according to Lenz's law.

8. **Does Lenz's law apply directly for closed circuit?**

Ans. Yes, Lenz's law holds directly to induced current and not to induced emf, which means that we can apply it directly to closed conducting loops. However if the loop is not closed, we imagine as it is closed and then from the direction of current, we can find the direction of induced emf.

9. **Name the factors by which the current, induced in a coil can be increased.**

Ans. The current induced in a coil can be increased by
(i) Using stronger magnetic field
(ii) Moving the loop faster
(iii) Replacing the loop by a coil of many turns.

10. **What are eddy currents?**

Ans. As magnetic flux also change through the core of the transformer, so induced currents are set up in closed paths in the body of the conductor. These induced current are set up in the direction perpendicular to the flux and are known as eddy currents.

11. **What do you mean by self-induction?**

Ans. The phenomenon in which the emf induced in a coil due to rate of change of current in the same coil is referred as self-induction.

12. **Define the SI unit of mutual inductance.**

Ans. The SI unit of mutual inductance is henry.
"If one volt emf is induced in coil due to rate of change of current of one ampere per second, the mutual inductance is said to be one henry". **(Grw 2008)**

13. **Name the factors on which the self-inductance of the coil depends?**

Ans. Self-inductance of a coil depends upon
* Number of turns of the coil
* Area of cross-section
* Nature of core material

(D.G.Khan 2005)

14. **Define motional emf. Give its unit.**

Ans. The emf induced by the motion of a conductor across a magnetic field is called motional emf.
Mathematically $\varepsilon = vBL \sin\theta$
The SI unit of motional emf (ε) is volt.

15. **Will the output voltage of a generator changes, if its speed of rotation is increased ?**

Ans. If speed of rotation is increased then output voltage of a generator increases, as $\varepsilon = N\omega AB \sin\theta$ where ω is the angular speed and ε is the output voltage.

(Bwp [illegible] 17)

16. **What is the effect of iron core on self-inductance?**

Ans. By placing an iron core, the magnetic flux and hence the inductance can be increased sufficiently relative to that for an air core. **(Lhr 2003, Grw 2003-2009)**

17. **Name the factors on which the mutual inductance of the coil depends.**

Ans. Mutual inductance depends upon
* Number of turns of coils
* Their area of cross-section
* Their closeness together
* Nature of core material

18. **What is armature and for a generator?**

Ans. Number of coils are wound around on iron cylinder which is rotated in the magnetic field. This assembly is called an armature.
The device in the circuit which consumes the electricity is referred as load.
The greater the load, the larger the current is supplied by the generator.

19. **What is purpose of commutators in DC generator?**

Ans. William Sturgeon invented a simple device called commutator that prevents the direction of current from reversing.

20. **What is the difference between practical transformer and ideal transformer?**

Ans. For an ideal transformer input power must equal to the output power while in case of practical transformer output power is always less than the input power.

21. **How power losses in transformer can be minimized?**

Ans. The power losses in transformer can be minimized as:
i) The core should be assembled from laminated sheets of a material whose hysterics area be very small.
ii) The insulation between laminated sheets be used to reduce the eddy currents.
iii) The resistance of primary and secondary coils should be very small.
iv) The coil should placed side by side to make proper flux linkage.

(Federal 2005-2006)

22. **How can we reduce the fluctuations in the output of a DC generator?**

Ans. The fluctuation of the output can be significantly reduced by using many coils rather than a single one. Multiple coils are wound on a cylindrical core in form of armature. Each coil is connected to a separate commutator to tapped the output at the peak value. Thus emf in the outer circuit is almost constant.

23. **State the working principle of DC motor?**

Ans. Working principle of DC motor is Torque produced in the current carrying coil when it is placed in uniform magnetic field. i.e.

$$\tau = NIAB \cos\alpha$$

24. **Name the factors on which the torque in the motor depends?**

Ans. The torque produced in the motor depends upon

i) Number of turns ii) Current flowing through the coil

iii) Area of the coil iv) Strength of magnetic field.

25. **What is the working principle of a transformer?**

Ans. The working of the transformer is based upon the principle of mutual induction, in which the changing currents in one coil produces the induced emf in another coil. (Lhr 2005)

26. **Why the current decreases in an ideal step up transformer?**

Ans. As we know for an ideal transformer $P_{in} = P_{out}$,

$$V_p I_p = V_s I_s$$

$$\text{or} \quad \frac{V_s}{V_p} = \frac{I_p}{I_s}$$

So according to above equation, in case of step up transformer, voltage and current are inversely proportional to each other, thus when voltage increases then the current will decrease.

27. **Why the windings of motor burn when it become over loaded?**

Ans. When motor become over loaded then it becomes difficult to rotate it, hence induced emf will decrease and current flows through it will increase, it may cause to burn the winding of the coil.

28. **What is the value of back emf in a motor when it is just started?**

Ans. The back emf in a motor is almost zero when it is just started. When motor speeds up back emf also increases and opposes the external voltage and as a result current in the motor decreases.

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. **When a motor is just started, back emf is almost ______**
   (a) Maximum (b) Zero (c) Minimum (d) Infinite
2. **Turn ratio of a transformer is 50. If 220 V AC is applied to its primary coil, voltage in the secondary coil will be:**
   (a) 44 V (b) 4.4 V (c) 220 V (d) 1100 V
3. **The mutual induction between two coils depends upon:**
   (a) Area of the coils (b) Number of the turns
   (c) Distance between the coils (d) All of these
4. **If we make the magnetic field stronger, the value of induced current is:**
   (a) Decreased (b) Increased
   (c) Vanished (d) Kept constant
5. **One henry is equal to:**
   (a) $Vs^{-1}A$ (b) $N.mA^{-1}$ (c) $V^{-1}.s.A$ (d) $V.s.A^{-1}$
6. **To construct a step down transformer:**
   (a) $N_s < N_p$ (b) $N_p < N_s$ (c) $N_s = N_p$ (d) $N_s . N_p = I$
7. **Eddy currents produced in the core of transformer are responsible for**
   (a) heat loss (b) step up process
   (c) step down process (d) induction phenomenon
8. **Alternating current generator converts which type of energy into to electrical energy**
   (a) mechanical energy (b) chemical energy
   (c) solar energy (d) potential energy
9. **The inductance is more in self induction with**
   (a) air cored coil (b) iron core
   (c) tungsten core (d) steel core

10. Induced emf in a coil according to Faraday's Law is

(a) $\varepsilon=-N\frac{\Delta\phi}{\Delta t}$ (b) $\varepsilon=-\frac{\Delta\phi}{N\Delta t}$ (c) $\varepsilon=-N\frac{\Delta t}{\Delta\phi}$ (d) $\varepsilon=-\frac{\Delta t}{N\Delta\phi}$

11. The magnetic flux linked with a circuit when a unit current flows through it is known as

(a) induced current (b) induced emf
(c) coefficient of self inductance (d) none of these

12. When the back emf in a circuit is zero, it draws

(a) zero current (b) maximum current
(c) minimum current (d) average current

13. The component in a generator which consumes electrical energy is called

(a) capacitor (b) load (c) split rings (d) commutator

14. The practical application of the mutual induction phenomenon is

(a) electric motor (b) transformer (c) AC generator (d) transistor

15. The energy density of the inductor is

(a) $\frac{B^2}{2\mu_o^2}$ (b) $\frac{\mu_o}{2B}$ (c) $\frac{B^2}{2\mu_o}$ (d) zero

16. The self inductance of a long solenoid with n turns per unit length is

(a) $L=\frac{\mu_o nA}{l}$ (b) $L=\frac{\mu_o n^2 A}{l}$ (c) $L=\mu_o n^2 Al$ (d) $L=\frac{\mu_o n^2 l}{A}$

17. A transformer works on

(a) AC only (b) DC only (c) Both AC and DC (d) has no hysterisis loss

18. If velocity of a conductor moving through a magnetic field B is made zero, them motional emf is

(a) – vBL (b) – v/BL (c) – BL/v (d) zero

19. The principle of an alternating current generator is based on

(a) coulomb's law (b) ampere's law (c) faraday's law (d) gauss's law

20. The ratio of average induced emf to the rate of change of current in the coil is

(a) self inductance (b) mutual inductance
(c) self induction (d) mutual induction

21. SI unit of mutual inductance and self inductance are

(a) same (b) different (c) no units (d) none of these

22. An inductor may store energy in

(a) its magnetic field (b) its electric field
(c) its coils (d) a neighboring circuit

Answers Key:

1.	(c) Minimum	12.	(b) maximum current
2.	(b) 4.4 V	13.	(b) load
3.	(d) All of these	14.	(b) transformer
4.	(b) Increased	15.	(c) $\frac{B^2}{2\mu_o}$
5.	(d) $V.s.A^{-1}$	16.	(c) $L=\mu_o n^2 Al$
6.	(a) $N_s < N_p$	17.	(a) AC only
7.	(a) heat loss	18.	(d) zero
8.	(a) mechanical energy	19.	(c) faraday's law
9.	(b) iron core	20.	(a) self inductance
10.	(a) $\varepsilon=-N\frac{\Delta\phi}{\Delta t}$	21.	(a) same
11.	(c) coefficient of self inductance	22.	(a) its magnetic field

❀❀❀❀❀

Chapter 16

ALTERNATING CURRENT

Topic Wise MCQ's

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer:

Alternating Current, Phase of A.C

1. The current which keeps on reversing its direction (or polarity) with time is called
   (a) direct current (b) induced current
   (c) magnetic current (d) alternating current
2. Alternating current is that which is produced by a voltage source whose polarity
   (a) remains the same (b) keeps on reversing
   (c) changes 4times in a cycle (d) none of these
3. The main reason for the world-wide use of A.C. is that it can be transmitted to
   (a) long distance easily at low cost (b) short distance only
   (c) long distance at high cost (d) all of these
4. During the time interval T(time period) voltage source changes its polarity
   (a) two times (b) only once
   (c) four times (d) no change
5. The frequency of an A.C. may be associated with time period as
   (a) $f = T$ (b) $f = \sqrt{T}$
   (c) $f = \frac{1}{T}$ (d) $f = \frac{1}{\sqrt{T}}$
6. The most common source of an A.C. voltage is
   (a) Transformer (b) Battery
   (c) UPS (d) A.C. generator

7. Current in a dry cell is an example of
   (a) A.C. (b) D.C.
   (c) both A.C & D.C (d) none of these

8. The graph between alternating voltage and time is a
   (a) sine curve (b) cosine curve
   (c) tangent curve (d) none of these

9. The output voltage of an A.C. generator at time $t = T/4$ is given by
   (a) $V = V_o/2$ (b) $V = V_o$
   (c) $V = 0$ (d) $V = V_o/4$

10. An A.C. varies as a function of
   (a) time (b) voltage
   (c) current (d) distance

11. If the angular frequency of A.C. generator increases to double, then time period of A.C. will become
   (a) double (b) 4times
   (c) ¼ times (d) half

12. The angular frequency of rotation of an A.C. generator is given by
   (a) $\omega = \frac{2\pi}{T}$ (b) $\omega = \frac{2\pi}{f}$
   (c) $\omega = 2\pi T$ (d) $\omega = \frac{2\pi f}{T}$

13. The angle 'θ' through which the coil of an A.C. generator rotates in time 't' is given by
   (a) $\theta = \frac{2\pi f}{t}$ (b) $\theta = 2\pi ft$
   (c) $\theta = \pi ft$ (d) $\theta = \frac{\omega}{t}$

14. An incandescent lamp will reach its maximum brilliance________ times per second when connected to a 220V,50Hz source
   (a) 50 (b) 2
   (c) 150 (d) 100

15. The value of A.C. voltage or current that exists in a circuit at any instant is called
   (a) peak value (b) peak to peak value
   (c) instantaneous value (d) rms value

16. The output voltage of an A.C. generator at time $t = T/2$ is given by

   (a) $V = 0$ (b) $V = V_o$
   (c) $V = -V_o$ (d) $V = V_o/4$

17. The highest value reached by A.C. voltage or current in one cycle is called
   (a) average value (b) peak value
   (c) peak to peak value (d) instantaneous value

18. The p-p value of A.C. voltage wave form is
   (a) V_o (b) $2V_o$
   (c) zero (d) $V_o/2$

19. The average value of alternating current or voltage over a complete cycle is
   (a) positive (b) negative
   (c) zero (d) none of these

20. If V_o is the peak value of A.C. voltage, its rms value is
   (a) $V_o/\sqrt{2}$ (b) $\sqrt{2}V$
   (c) $V_o/2$ (d) $\sqrt{2}/V_o$

21. A sinusoidal current has rms (effective) value of 10A. Its maximum value is
   (a) $10\sqrt{2}$ A (b) $\frac{\sqrt{2}}{10}$ A
   (c) $\frac{10}{\sqrt{2}}$ A (d) 10 A

22. If I_o is the peak value of A.C. current, then the root mean square (rms) value of current will be
   (a) $I_o/2$ (b) $\sqrt{2}/I_o$
   (c) $\sqrt{2I_o}$ (d) $I_o/\sqrt{2}$

23. If I_o is the peak value of A.C. current, its average value over the complete cycle is:
   (a) $\sqrt{2}I_o$ (b) $I_o/\sqrt{2}$
   (c) $\sqrt{I_o/2}$ (d) zero

24. The rms value of A.C. current is given as
   (a) $I_{rms} = \sqrt{2}/I_o$ (b) $I_{rms} = I_o/\sqrt{2}$
   (c) $I_{rms} = 2\,I_o$ (d) $I_{rms} = \sqrt{2}/2\,I_o$

25. An A.C. volt meter reads 250V,its rms value is

(a) $\frac{250}{\sqrt{2}}$ V (b) 250V

(c) $250\sqrt{2}$ V (d) none of these

26. Square root of the average of squared value of an A.C. is called

(a) peak value (b) rms value

(c) p-p value (d) none of these

27. The peak value of A.C. voltage can be written as

(a) $V_o = \sqrt{\frac{V_{rms}}{2}}$ (b) $V_o = \frac{\sqrt{V_{rms}}}{2}$

(c) $V_o = \sqrt{2}V_{rms}$ (d) $V_o = \frac{V_{rms}}{2}$

28. The average of square value of alternating current or voltage over a complete cycle is

(a) negative (b) zero

(c) not zero (d) none of these

29. If the peak value of A.C. voltage is $30\sqrt{2}$, then its effective value (rms value) will be

(a) 0.707 volts (b) $\sqrt{2}$ volts

(c) $30\sqrt{2}$ volts (d) 30 volts

30. If we connect an ordinary D.C. ammeter to measure alternating current it would measure its

(a) peak value (b) peak to peak value

(c) average value over a cycle (d) instantaneous value

31. The rms value of A.C. is always

(a) negative (b) positive

(c) zero (d) none of these

32. A.C. is produced by

(a) motor (b) A.C generator

(c) D.C generator (d) both a and b

33. The angle which gives the instantaneous value of alternating voltage or current is called

(a) phase (b) critical angle

(c) instantaneous angle (d) alternating angle

34. The phase at the positive peak of A.C is

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$

(c) π (d) $\frac{3\pi}{4}$

35. The phase at the negative peak of A.C is

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$

(c) π (d) $\frac{3\pi}{2}$

36. The points where the waveform of A.C. crosses the time axis corresponds to phase

(a) 0 and π (b) 0 and $\frac{\pi}{2}$

(c) $\frac{\pi}{2}$ and π (d) $\frac{\pi}{2}$ and $\frac{\pi}{4}$

A.C. Circuits, A.C. Through Resistor, A.C. Through Capacitor

37. The phase angle between the voltage and current in resistive A.C. circuit is

(a) 0° (b) 90°

(c) 180° (d) 60°

38. The basic circuit element in a D.C. circuit which controls the current or voltage is a

(a) capacitor (b) inductor

(c) resistor (d) all of these

39. In A.C. circuit, current and voltage is controlled by

(a) resistor R (b) inductor L

(c) capacitor C (d) all of these

40. In pure resistive A.C. circuit, the instantaneous values of voltage and current are

(a) out of phase (b) in phase

(c) out of phase by 90° (d) out of phase by 45°

41. In pure resistive A.C. circuit, the vectors of V and I are drawn______ to each other

(a) parallel (b) perpendicular

(c) anti-parallel (d) none of these

42. The power dissipated in a resistive circuit is

(a) $P = I^2R$ (b) $P = \frac{V^2}{R}$

(c) $P = VI$ (d) all of these

43. The expression P = VI holds only when current and voltage are

(a) in phase (b) out of phase

(c) at right angle to each other (d) parallel to each other

44. The flow of D.C. is blocked by

(a) resistor (b) inductor

(c) capacitor (d) all of these

45. A device that allows only the continuous flow of A.C. through a circuit is

(a) inductor (b) capacitor

(c) resistor (d) all of these

46. As A.C. continuously flows through the plates of a capacitor because of

(a) charging of plates (b) discharging of plates

(c) charging and discharging of plates

(d) dielectric present between the plates

47. The opposition offered by a capacitor to the flow of A.C. is called its

(a) capacitance (b) inductance

(c) reactance (d) none of these

48. The reactance X_C of a capacitor joined across alternating source can be found by the relation

(a) $X_C = \frac{I_{rms}}{V_{rms}}$ (b) $X_C = \frac{V_{rms}}{I_{rms}}$

(c) $X_C = \frac{I_{rms}}{\sqrt{V_{rms}}}$ (d) $X_C = \frac{\sqrt{I_{rms}}}{V_{rms}}$

49. The reactance of a capacitor is given by

(a) $X_C = \frac{1}{\omega C}$ (b) $X_C = \omega C$

(c) $X_C = \frac{\omega}{C}$ (d) $X_C = \frac{C}{\omega}$

50. The unit of reactance is

(a) tesla (b) farad

(c) volts (d) ohms

51. The reactance X_C for a capacitor joined across an alternating source of frequency f is

(a) $X_C = 2\pi fC$ (b) $X_C = \frac{1}{2\pi fC}$

(c) $X_C = \frac{2\pi}{fC}$ (d) $X_C = \frac{fC}{2\pi}$

52. A capacitor of 2000 μF is connected across alternating source of 20 volts. If frequency of the source is 50/π Hz then reactance of the capacitor is:

(a) 5 Ω (b) 2.5 Ω

(c) 50 Ω (d) 200 Ω

53. In a capacitive A.C. circuit the charge q and applied voltage V are

(a) In phase (b) out of phase

(c) parallel to each other (d) at right angle to each other

54. In a pure capacitor A.C. circuit, the current I and charge q are

(a) in phase (b) out of phase

(c) parallel to each other (d) out of phase by 30°

55. In a pure capacitor A.C. circuit, the current and the applied voltage are

(a) in phase (b) out of phase

(c) parallel to each other (d) none of these

56. In capacitive circuit, at high frequency, the current will be

(a) Large (b) small

(c) Zero (d) infinite

57. In capacitive circuit, at high frequency, the reactance will be

(a) Large (b) small

(c) Zero (d) infinite

58. In a capacitive circuit, at low frequency, the reactance will be

(a) large (b) small

(c) zero (d) infinite

59. In capacitor circuit, at low frequency, the current will be

(a) large (b) small

(c) zero (d) infinite

60. Instantaneous charge on a capacitor is given by

(a) $q = CV_o \sin \omega t$ (b) $q = CV_o \tan \omega t$

(c) $q = CV_o \sin \pi ft$ (d) $q = CV_o \cos \pi ft$

61. In an A.C. circuit with pure capacitor only, the current
(a) lags behind voltage by 90°
(b) leads the voltage by 90°
(c) in phase with voltage
(d) leads the voltage by 270°

62. A device that allows only the continuous flow of an A.C. through a circuit is
(a) capacitor (b) inductor
(c) generator (d) transformer

A.C. Through Inductor, Impedance

63. The opposition offered by the inductor to the flow of A.C. is called
(a) capacitance (b) Resistance
(c) inductive reactance (d) inductance

64. The inductive reactance is given by the expression
(a) $X_L = \dfrac{1}{\omega L}$ (b) $X_L = \omega L$
(c) $X_L = \dfrac{2\pi}{\omega L}$ (d) $X_L = \dfrac{\omega L}{2\pi}$

65. The inductive reactance of the coil is given by the expression
(a) $X_L = 2\pi fL$ (b) $X_L = 2\pi fC$
(c) $X_L = \dfrac{1}{2\pi fL}$ (d) $X_L = \dfrac{1}{2\pi fC}$

66. The frequency for 2 henry inductor having reactance of 1000 Ω is
(a) 40 Hz (b) 80 Hz
(c) 50 Hz (d) 220 Hz

67. In a pure inductor coil, the power dissipated is
(a) zero (b) infinite
(c) maximum (d) none of these

68. Inductor coils can be used in A.C. circuit
(a) to absorb the electrical energy
(b) to control the rise of temperature
(c) to control the A.C.

(d) all of these

69. The SI unit of inductance is
(a) farad (b) henry
(c) volts (d) ohm

70. In an inductive AC circuit, the current
(a) leads the voltage by 90°
(b) lags behind the voltage by 90°
(c) leads the voltage by 180°
(d) lags behind voltage by 180°

71. The inductance and capacitance behave as a function of
(a) Current (b) voltage
(c) Frequency (d) power

72. At low frequency of the alternating current, the inductive reactance X_L
(a) Increases (b) decreases
(c) remains the same (d) none of these

73. At low frequency of the alternating current, the current will be
(a) Small (b) large
(c) Zero (d) infinite

74. The reactance of a coil changes directly with
(a) the inductance (b) frequency of A.C.
(c) both inductance and frequency of A.C.
(d) Capacitance

75. As frequency of AC increases
(a) X_C increases (b) X_L decreases
(c) X_L ed X_C increases (d) none of these

76. The behaviour of resistance is independent of
(a) current (b) voltage
(c) both a & b (d) frequency

77. The inductive reactance is directly proportional to
(a) frequency of AC (b) inductance
(c) both frequency & inductance (d) none of these

78. The combined effect of resistance and reactances in an AC circuit is called

(a) capacitance (b) conductance
(c) resistance (d) impedance

79. The impedance Z can be expressed as

(a) $Z = \frac{V_{rms}}{I_{rms}}$ (b) $Z = \frac{I_{rms}}{V_{rms}}$
(c) $Z = V_{rms} I_{rms}$ (d) $Z = V^2_{rms} I_{rms}$

80. SI unit of impedance is

(a) ohm (b) ohm-meter
(c) mho (d) $(\text{ohm-meter})^{-1}$

81. Ohm is the unit of

(a) resistance (b) reactance
(c) impedance (d) all of these

82. When 10 V are applied to an A.C. circuit, the current flowing in it is 100 mA. its impedance will be

(a) 50 Ω (b) 100 Ω
(c) 150 Ω (d) 200 Ω

83. The ratio of the rms value of the applied voltage to the rms value of A.C. is called

(a) capacitance (b) conductance
(c) inductance (d) impedance

R-C And R-L Series Circuits, Power In A.C. Circuits

84. For R-C series A.C. circuit, the applied voltage is given by

(a) $V = I\sqrt{R^2 + (\omega C)^2}$ (b) $V = I\sqrt{R^2 + \frac{1}{(\omega C)^2}}$
(c) $V = \sqrt{R^2 + \frac{I}{\omega C}}$ (d) $V = \sqrt{I^2R + \frac{1}{(\omega C)^2}}$

85. For R- L series A.C. circuit, the applied voltage is given by

(a) $V = I\sqrt{R^2 + (\omega L)^2}$ (b) $V = I\sqrt{R^2 + \frac{1}{(\omega L)^2}}$
(c) $V = \sqrt{R^2 + \frac{I}{\omega L}}$ (d) $V = \sqrt{I^2R + \frac{1}{(\omega L)^2}}$

86. The impedance of R-C series A.C. circuit is given by

(a) $Z = \sqrt{R^2 + (\omega C)^2}$ (b) $Z = \sqrt{R^2 + \frac{1}{(\omega C)^2}}$
(c) $Z = \sqrt{\frac{1}{R^2} + (\omega C)^2}$ (d) $Z = \sqrt{\frac{1}{R^2} + \frac{1}{(\omega C)^2}}$

87. The impedance of R-L series A.C. circuit is given by

(a) $Z = \sqrt{R^2 + (\omega L)^2}$ (b) $Z = \sqrt{R^2 + \frac{1}{(\omega L)^2}}$
(c) $Z = \sqrt{\frac{1}{R^2} + (\omega C)^2}$ (d) $Z = \sqrt{\frac{1}{R^2} + \frac{1}{(\omega C)^2}}$

88. In a R-C series circuit, the current

(a) leads the applied voltage (b) lags the applied voltage
(c) is in phase with V (d) none of these

89. In a R-L series circuit, the current

(a) leads the applied voltage (b) lags the applied voltage
(c) either of these (d) none of these

90. For a R-C circuit, current leads the voltage by phase angle

(a) $\theta = \tan^{-1}\left(\frac{\omega C}{R}\right)$ (b) $\theta = \tan^{-1}\left(\frac{R}{\omega C}\right)$
(c) $\theta = \tan^{-1}\frac{1}{(\omega CR)^2}$ (d) $\theta = \tan^{-1}\left(\frac{1}{\omega CR}\right)$

91. For a R-L circuit, the voltage leads the current by phase angle

(a) $\theta = \tan^{-1}\left(\frac{R}{\omega L}\right)$ (b) $\theta = \tan^{-1}(\omega LR)$
(c) $\theta = \tan^{-1}\left(\frac{1}{\omega LR}\right)$ (d) $\theta = \tan^{-1}\left(\frac{\omega L}{R}\right)$

92. For R-C and R-L series circuit, if we take R as reference, then the reactance X_C and X_L are

(a) directed perpendicular to each other
(b) directed parallel to each other
(c) directed opposite to each other
(d) none of these

93. The expression P = VI is true in case of A.C. circuit when
(a) V and I are out of phase (b) V and I are in phase
(c) either of these (d) none of these

94. The power dissipated in a pure inductive or capacitance circuit is
(a) zero (b) maximum
(c) minimum (d) moderate

95. In the equation $P = IV\cos\theta$, $\cos\theta$ is called
(a) common factor (b) voltage factor
(c) integral factor (d) power factor

96. The A.C. circuit in which current and voltage are in phase, the power factor is
(a) zero (b) 1
(c) infinity (d) negative

97. The frequency at which an inductor of 1.0 H have a reactance of 500 Ω is
(a) 60 Hz (b) 70 Hz
(c) 80 Hz (d) 90 Hz

Series Resonance Circuit, Parallel Resonance Circuit

98. In RLC series circuit, the true condition of resonance takes place when
(a) $X_L > X_C$ (b) $X_L < X_C$
(c) $X_L = X_C$ (d) $X_L \geq X_C$

99. When $X_L = X_C$ in RLC - series A.C. circuit this condition is called
(a) null (b) balanced
(c) resonance (d) critical

100. The value of resonance frequency f_r in case of series resonance circuit is given by
(a) $f_r = 2\pi\sqrt{LC}$ (b) $f_r = \dfrac{1}{\sqrt{2\pi LC}}$
(c) $f_r = \dfrac{2\pi}{\sqrt{LC}}$ (d) $f_r = \dfrac{1}{2\pi\sqrt{LC}}$

101. In RLC series circuit, the current at resonance frequency is
(a) maximum (b) minimum
(c) zero (d) infinite

102. At resonance frequency, the impedance of RLC series circuit is
(a) zero (b) minimum

(c) maximum (d) moderate

103. In RLC series circuit, the impedance of the circuit at resonance is
(a) inductive (b) resistive
(c) capacitive (d) none of these

104. In RLC series circuit, at high frequencies
(a) X_C is smaller than X_L (b) X_C is greater than X_L
(c) X_C is equal to X_L (d) none of these

105. In RLC series circuit, at low frequencie
(a) X_C is smaller than X_L (b) X_C is greater than X_L
(c) X_C is equal to X_L (d) none of these

106. A resonance curve for RLC series circuit is a plot of frequency versus
(a) current (b) impedance
(c) resistance (d) voltage

107. In the RLC parallel circuit, the resonance frequency is
(a) $f_r = 2\pi\sqrt{LC}$ (b) $f_r = \dfrac{1}{\sqrt{LC}}$
(c) $f_r = 2\pi\sqrt{LC}$ (d) $f_r = \dfrac{1}{2\pi\sqrt{LC}}$

108. In the resonance condition of RLC series circuit, the power factor is
(a) 0 (b) 1
(c) 2 (d) 3

109. In RLC series circuit, at resonance condition, the voltage and current are
(a) in phase (b) out of phase
(c) perpendicular to each other (d) none of these

110. In L-C parallel circuit, the capacitor draws a
(a) leading current (b) lagging current
(c) either of these (d) none of these

111. In L-C parallel circuit, the coil draws a
(a) leading current (b) lagging current
(c) either of these (d) none of these

112. For practical L-C parallel circuits, the current at resonance frequency is
(a) minimum (b) maximum
(c) Zero (d) infinite

113. For practical L-C parallel circuit, at resonance frequency, the circuit impedance is
(a) minimum (b) maximum

(c) zero
(d) infinite

114. In L-C parallel circuit, at the resonance condition, the current and applied voltage are
(a) in phase
(b) out of phase
(c) either of these
(d) none of these

115. In L-C parallel circuit, at resonance condition, the power factor is
(a) 0
(b) 1
(c) 2
(d) 3

116. The capacitance required to construct a resonance circuit of frequency 1000 KHz with an inductor of 5 mH is
(a) 5.09 F
(b) 5.09 pF
(c) 5.09 nF
(d) none of these

Three Phase A.C. Supply, Principle Of Metal Detectors, Choke

117. A three phase A.C. generator consists of________ coils
(a) only one
(b) two
(c) three
(d) four

118. In a three phase A.C. generator, the phase difference between each pair of coils is equal to
(a) 45°
(b) 90°
(c) 120°
(d) 180°

119. Voltage across any two lines of a three phase A.C. supply is about
(a) 120 V
(b) 220 V
(c) 240 V
(d) 400 V

120. In three phase A.C. generator, the voltage between any line and the neutral line is
(a) 120 V
(b) 280 V
(c) 230 V
(d) 400 V

121. In a three phase A.C. generator, there are three coils inclined at
(a) 60° to each other
(b) 90° to each other
(c) 120° to each other
(d) 200° to each other

122. In a three phase A.C. generator, if the first coil has phase 0, then the other two will have phases
(a) 0° and 90°
(b) 60° and 180°
(c) 120° and 240°
(d) 120° and 230°

123. In three phase supply, total load is divided into
(a) two parts
(b) three parts
(c) four parts
(d) infinite parts

124. Metals detectors are made by the combination of
(a) R-C circuits
(b) L-C circuits
(c) R-L-C circuits
(d) none of these

125. Metals detectors can be used to locate
(a) aeroplanes
(b) buried metal objects
(c) Ships
(d) all of these

126. In metal detectors, in the presence of any metal near inductor B i.e.(search coil)
(a) $L_A < L_B$
(b) $L_A > L_B$
(c) $L_A = L_B$
(d) none of these

127. In metal detectors, when the search coil comes near a metal object, its inductance
(a) increases and corresponding frequency increases
(b) increases and corresponding frequency decreases
(c) decreases and corresponding frequency increases
(d) decreases and corresponding frequency decreases

128. A choke is a coil having
(a) low inductance and low resistance
(b) high inductance and high resistance
(c) low inductance and high resistance
(d) high inductance and low resistance

129. A choke coil is used to limit current in
(a) A.C. circuit
(b) D.C. circuits
(c) both A.C & D.C. circuits
(d) none of these

130. Choke consumes extremely small
(a) current
(b) voltage
(c) charge
(d) power

Electromagnetic Waves, Principle Of Generation, Transmission And Reception Of Electromagnetic Waves

131. The waves which do not require any material medium for their propagation are called
(a) matter waves
(b) mechanical waves
(c) stationary waves
(d) electromagnetic waves

132. Maxwell's equation were discovered by James Clark Maxwell in
(a) 1870
(b) 1970
(c) 1905
(d) 1864

133. In free space, the speed of electromagnetic waves is
(a) 3×10^7 m/s
(b) 3×10^8 m/s
(c) 3×10^{10} m/s
(d) 3×10^9 m/s

134. Which one of the following waves are not electromagnetic waves?

(a) string waves (b) sound waves
(c) both a and b (d) x-rays

135. A changing magnetic field creates a
(a) electric field (b) magnetic field
(c) gravitational field (d) conservative field

136. Electromagnetic waves were discovered by
(a) Einstein (b) Newton
(c) Maxwell (d) Thomson

137. Electromagnetic waves consists of
(a) uniform electric field (b) uniform magnetic field
(c) varying electric and magnetic field (d) uniform electric and magnetic field

138. The examples of electromagnetic waves are
(a) microwaves (b) radio waves
(c) gamma ray (d) all of these

139. The electric field and magnetic field and the direction of propagation of electromagnetic waves are mutually
(a) parallel (b) anti-parallel
(c) orthogonal (d) none of these

140. Which of the following waves are more energetic
(a) x-rays (b) infrared waves
(c) ultraviolet rays (d) γ-rays

141. Which of the following has greater frequency?
(a) x-rays (b) γ-rays
(c) infrared rays (d) ultraviolet rays

142. Which of the following has smallest wavelength?
(a) x-rays (b) γ-rays
(c) infrared rays (d) ultraviolet rays

143. Radio waves have________ than light waves.
(a) higher frequency (b) lower frequency
(c) very high frequency (d) none of these

144. Shake an electrically charged object to and fro you produce
(a) longitudinal waves (b) sound waves

(c) e.m. waves (d) bsoth a and c

145. Which of the following EMW has the longest wavelength?
(a) γ-rays (b) X-rays
(c) radio-waves (d) Infrared waves

146. The electric or magnetic field does radiate in space whenever a charge is
(a) at rest
(b) moving with uniform velocity
(c) both a and b
(d) none of these

147. A radio transmitting antenna provides a good example of generating
(a) heat waves (b) sound waves
(c) light waves (d) electromagnetic waves

148. Electromagnetic waves emitted from an antenna are
(a) transverse (b) longitudinal
(c) stationary (d) all of these

149. The sound waves are converted into electrical signal by using
(a) ammeter (b) galvanometer
(c) microphone (d) an antenna

150. In free space, the radio waves travel with a speed
(a) greater than speed of light (b) less than speed of light
(c) equal to speed of light (d) none of these

151. The piece of wire through which charges are made to accelerate by mean o em waves is known as:
(a) receiving antenna (b) transmitting antenna
(c) either of these (d) none of these

152. The wire receiving the waves is known as
(a) transmitting antenna (b) receiving antenna
(c) resistive wire (d) shunt wire

153. When electrons in a transmitting antenna vibrate 94000 times each second, they produce radio waves having frequency:
(a) 100 KHz (b) 120 KHz
(c) 80 KHz (d) 94 KHz

154. The frequency of the range 20 to 20,000 Hz is:

(a) visible (b) ultrasonic
(c) audible (d) in audible

155. Electromagnetic waves transport:
(a) charge (b) current
(c) potential (d) energy

156. In an electromagnetic waves, the electric and magnetic field are:
(a) parallel to each other (b) anti-parallel to each other
(c) perpendicular to each other (d) none of these

157. Electromagnetic waves are generated when
(a) only electric field changes
(b) only magnetic field changes
(c) both electric and magnetic field changes
(d) none of these

158. The frequency of electromagnetic waves received through a LC - circuit is adjusted by
(a) resistor (b) capacitor
(c) resistor & inductor (d) all of these

159. In our radio receiver set, when we change station, or change the frequency we actually adjust the value of
(a) resistance (b) power
(c) capacitance (d) all of these

Modulation

160. The process of combining the low frequency signal with a high frequency signal is called
(a) amplification (b) rectification
(c) modulation (d) resonance

161. In the modulation process, high frequency signal is called
(a) carrier wave (b) modulated signal
(c) unmodulated signal (d) modulated carrier wave

162. In the modulation process, low frequency signal is called
(a) carrier wave (b) modulating signal
(c) unmodulated signal (d) modulated carrier wave

163. As a result of modulation, the resulting wave is called

(a) carrier wave (b) modulated signal
(c) modulated carrier wave (d) none of these

164. Modulation can be achieved by
(a) changing the amplitude of carrier waves
(b) changing the frequency of carrier waves
(c) either of these
(d) none of these

165. The amplitude modulation (A.M.) transmission, frequencies range from
(a) 88 KHz to 108 KHz (b) 88 MHz to 108 MHz
(c) 540 KHz to 1600 KHz (d) 540 MHz to 1600 MHz

166. The frequency modulation (F.M.) transmission, frequencies range from
(a) 88 KHz to 108 KHz (b) 88 MHz to 108 MHz
(c) 540 KHz to 1600 KHz (d) 540 MHz to 1600 MHz

167. For frequency modulated signal, the frequency of the modulated carrier wave is highest when the signal amplitude is at its
(a) Minimum (b) maximum
(c) either of these (d) none of these

168. For frequency modulated signal, the frequency of the modulated carrier wave is lowest when the signal amplitude is at its
(a) minimum (b) maximum
(c) either of these (d) none of these

169. For frequency modulated signal, the frequency of the modulated carrier wave is at its normal value when the signal amplitude is at its
(a) maximum negative value (b) maximum positive value
(c) zero value (d) none of these

170. Waves we prefer for transmission of radio signals have
(a) Wave length larger than infrared (b) wave length shorter than infrared
(c) infrared waves (d) none of these

171. Which radio is affected less by electrical interference?
(a) A.M. (b) F.M.
(c) both of these (d) none of these

172. Which waves are less able to travel around obstacles such as hills and large buildings?
(a) A.M. (b) F.M.
(c) microwaves (d) all of these

Answer Key's

1.	(d) alternating current	2.	(b) keeps on reversing
3.	(a) long distance easily at low cost	4.	(b) only once
5.	(c) $f = \frac{1}{T}$	6.	(d) A.C. generator
7.	(b) D. C.	8.	(a) sine curve
9.	(b) $V = V_o$	10.	(a) time
11.	(d) half	12.	(a) $\omega = \frac{2\pi}{T}$
13.	(b) $\theta = 2\pi ft$	14.	(d) 100
15.	(c) instantaneous value	16.	(a) $V = 0$
17.	(b) peak value	18.	(b) $2V_o$
19.	(c) zero	20.	(a) $V_o/\sqrt{2}$
21.	(a) $10\sqrt{2}$ A	22.	(d) $I_o/\sqrt{2}$
23.	(d) zero	24.	(b) $I_{rms} = \sqrt{2}/2\ I_o$
25.	(b) 250V	26.	(b) rms value
27.	(c) $V_o = \sqrt{2}V_{rms}$	28.	(c) not zero
29.	(d) 30 volts	30.	(c) average value over a cycle
31.	(b) positive	32.	(b) A.C. generator
33.	(a) phase	34.	(a) $\frac{\pi}{2}$
35.	(d) $\frac{3\pi}{2}$	36.	(a) 0 and π
37.	(a) 0^o	38.	(c) resistor
39.	(d) all of these	40.	(b) in phase
41.	(a) parallel	42.	(d) all of these
43.	(a) in phase	44.	(c)
45.	(b) capacitor	46.	(c) charging and discharging of plates

47.	(c) reactance	48.	(b) $X_C = \frac{V_{rms}}{I_{rms}}$
49.	(a) $X_C = \frac{1}{\omega C}$	50.	(d) ahms
51.	(b) $X_C = \frac{1}{2\pi fC}$	52.	(a) 5 Ω
53.	(a) in phase	54.	(b) out of phase
55.	(b) out of phase	56.	(a) large
57.	(b) small	58.	(a) large
59.	(b) small	60.	(a)
61.	(b) leads the voltage by 90º	62.	(a) capacitor
63.	(c) inductive reactance	64.	(b) $X_L = \omega L$
65.	(a) $X_L = 2\pi fL$	66.	(b) 80 Hz
67.	(a) zero	68.	(c) to control the A.C.
69.	(b) Henry	70.	(b) lags behind the voltage by 90º
71.	(c) frequency	72.	(b) decreases
73.	(b) large	74.	(c) both inductance and frequency of A.C.
75.	(d) none of these	76.	(d) frequency
77.	(a) frequency of AC	78.	(d) impedance
79.	(a) $Z = \frac{V_{rms}}{I_{rms}}$	80.	(a) ohm
81.	(d) all of these	82.	(b) 100 Ω
83.	(d) impedance	84.	(b) $V = I\sqrt{R^2 + \frac{1}{(\omega C)^2}}$
85.	(a) $V = I\sqrt{R^2 + (\omega L)^2}$	86.	(b) $Z = \sqrt{R^2 + \frac{1}{(\omega C)^2}}$
87.	(a) $Z = \sqrt{R^2 + (\omega L)^2}$	88.	(a) leads the applied voltage
89.	(b) lags the applied voltage	90.	(d) $\theta = \tan^{-1}\left(\frac{1}{\omega CR}\right)$

91.	(d) $\theta = \tan^{-1}\left(\frac{\omega L}{R}\right)$	92.	(c) directed opposite to each other
93.	(b) V and I are in phase	94.	(a) zero
95.	(d) power factor	96.	(b) 1
97.	(c) 80 Hz	98.	(c) $X_L = X_C$
99.	(c) resonance	100.	(d) $f_r = \frac{1}{2\pi\sqrt{LC}}$
101.	(a) maximum	102.	(b) minimum
103.	(b) resistive	104.	(a) X_C is smaller than X_L
105.	(b) X_C is greater than X_L	106.	(a) current
107.	(d) $f_r = \frac{1}{2\pi\sqrt{LC}}$	108.	(b) 1
109.	(a) in phase	110.	(a) leading current
111.	(b) lagging current	112.	(a) minimum
113.	(b) maximum	114.	(a) in phase
115.	(b) 1	116.	(b) 5.09 pF
117.	(c) three	118.	(c) 120º
119.	(d) 400 V	120.	(c) 230 V
121.	(c) 120º to each other	122.	(c) 120º and 240º
123.	(b) three parts	124.	(b) L-C circuits
125.	(b) buried metal objects	126.	(b) $L_A > L_B$
127.	(c) decreases and corresponding frequency increases	128.	(d) high inductance and low resistance
129.	(a) A.C. circuit	130.	(d) power
131.	(d) electromagnetic waves	132.	(d) 1864
133.	(b) 3×10^8 m/s	134.	(c) both a and b
135.	(a) electric field	136.	(c) Maxwell
137.	(c) varying electric and magnetic field	138.	(d) all of these
139.	(c) orthogonal	140.	(d) γ-rays
141.	(b) γ-rays	142.	(c) infrared rays
143.	(b) lower frequency	144.	(c) e.m. waves

145.	(c) radio-waves	146.	(d) none of these
147.	(d) electromagnetic waves	148.	(a) transverse
149.	(d) an antenna	150.	(c) equal to speed of light
151.	(a)receiving antenna	152.	(b) receiving antenna
153.	(d) 94 KHz	154.	(d) in audible
155.	(d) energy	156.	(c) perpendicular to each other
157.	(c) both electric and magnetic field changes	158.	(b) capacitor
159.	(c) capacitance	160.	(c) modulation
161.	(a) carrier wave	162.	(b) modulating signal
163.	(c) modulated carrier wave	164.	(c) either of these
165.	(c) 540 KHz to 1600 KHz	166.	(b) 88 MHz to 108 MHz
167.	(b) maximum	168.	Minimum
169.	(c) zero value	170.	(a) wave by larger than infrared
171.	(b) F.M.	172.	(b) F.M

Brain Teasing MCQ's (with Hints)

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer:

1. Which of the following is the time taken by an A.C of frequency 50Hz to complete one cycle?

(a) 0.5 Sec (b) 0.2 Sec
(c) 0.02 Sec (d) 0.002 Sec

2. The peak value of A.C is $2\sqrt{2}$ A. Which of the following will be its apparent value?

(a) zero (b) $\frac{\sqrt{2}}{2}$ A
(c) $\frac{2}{\sqrt{2}}$ A (d) 2A

3. The effective value of A.C in a circuit is 10A. Which of the following will be its peak value.
(a) 14.14A (b) 7.07A
(c) 5A (d) 0.707A

4. An electric bulb is designed to operate at 12V DC. It is connected to AC and gives same brightness then peak AC value of voltage is
(a) 12V (b) $12\sqrt{2}$
(c) 18V (d) 24V

5. Dimensions of RC matches with
(a) RL (b) $\frac{R}{L}$
(c) $\frac{L}{C}$ (d) $\frac{L}{R}$

6. The reactance of a capacitor at 50Hz is 10Ω. Which of the following will be its reactance at 100Hz?
(a) 20Ω (b) 10Ω
(c) 5Ω (d) 1Ω

7. The power factor in wattless current is
(a) zero (b) $\frac{1}{2}$
(c) 1 (d) infinity

8. In RLC series circuit $X_L = X_C$. Which of the following will be the power factor?
(a) zero (b) $\frac{1}{2}$
(c) 1 (d) infinity

9. AC voltmeter measure
(a) Peak voltage (b) r.m.s voltage
(c) average voltage (d) All of above

10. Electromagnetic waves do not transport any:
(a) energy (b) charge
(c) momentum (d) information

11. Which of the following radiations forms the part of electromagnetic spectrum?
(a) alpha rays (b) beta rays
(c) cathode rays (d) gamma rays

12. Choke coil in A.C circuit is used for
(a) increasing voltage (b) decreasing current
(c) increasing current (d) decreasing voltage

13. The sharpness of resonance RLC series resonant circuit, as the resistance of the circuit is increased,
(a) changes from infinity to zero (b) changes from zero to infinity
(c) goes on decreasing (d) goes on increasing

14. The range of values of power factor is
(a) 0 to ∞ (b) 0 to –1
(c) 2 to ∞ (d) 0 to 1

15. In pure RLC circuit, the energy is dissipated in:
(a) R only (b) R and L only
(c) R and C only (d) R, L and C

16. Choke used to limit high frequency A.C has
(a) A paramagnetic core (b) A diamagnetic core
(c) air core (d) iron core

17. The power factor of an A.C circuit has
(a) SI unit ampere (b) SI unit volt
(c) SI unit watt (d) no unit

18. The speed of electromagnetic wave in vaccum is given by
(a) $\mu_o \in_o$ (b) $\sqrt{\mu_o \in_o}$
(c) $\frac{1}{\sqrt{\mu_o \in_o}}$ (d) $\sqrt{\frac{\mu_o}{\in_o}}$

19. If E and B be electric and magnetic field vectors of an electromagnetic wave, Then propagation of wave is along the direction of
(a) E (b) B
(c) E × B (d) None of these

20. Which of the following electromagnetic waves have shortest wavelength?
(a) micro waves (b) ultraviolet waves
(c) infrared waves (d) Radio waves

Answer with Hints

No.	Correct Option	Answers	Hint
1	c	0.02 Sec	$T = \frac{1}{f} = \frac{1}{50} = 0.02$ Sec
2	d	2A	$I_{r.m.s} = \frac{I_o}{\sqrt{2}} = \frac{2\sqrt{2}}{\sqrt{2}} = 2A$
3	a	14.14 A	$I_o = I\,r.m.s$ $I_o = \sqrt{2} \times 10$ $I_o = 14.14A$
4	b	$12\sqrt{2}$	$I_o = \sqrt{2}\,I\,r.m.s$
5	d	$\frac{L}{R}$	$\frac{L}{R} = \frac{[ML^2T^{-2}A^{-2}]}{[ML^2T^{-3}A^{-2}]} = T$
6	c	5Ω	$X_C = \frac{1}{2\pi fc}$ When f is doubled then XC reduces half
7	a	Zero	
8	c	1	
9	b	r.m.s voltage	
10	b	Charge	
11	d	gamma rays	
12	b	decreasing current	
13	c	goes on decreasing	
14	d	0 to 1	
15	a	R only	
16	d	iron core	
17	d	no unit	
18	c	$\frac{1}{\sqrt{\mu_o \epsilon_o}}$	
19	c	$\vec{E} \times \vec{B}$	
20	b	Ultraviolet waves	

Additional Short Questions

1. **Show that $\frac{L}{R}$ has the unit of time (sec).**

Ans. As $\varepsilon = L\frac{\Delta I}{\Delta t}$

$$\Rightarrow L = \frac{\epsilon\,\Delta t}{\Delta I}$$

$$\text{Unit of } L = \frac{Vs}{A}$$

$$R = \frac{V}{I}$$

$$\text{Unit of } R = \frac{V}{A}$$

$$\text{Unit of } \frac{L}{R} = \frac{Vs/A}{V/A}$$

$$= \frac{VsA}{AV}$$

$$= \text{sec}$$

2. **Write down some advantages and disadvantage of the use of ac supply?**

Ans. **Advantages:**

Its power loses are small.
Its transmission cost is low.
It may step up or step down by mean of transformer.

Dis-Advantages:

It is more dangerous than dc.
It can not be used for electrolysis.
It can not be used for charging of the cell.
It can never be stored

3. **230 V A.C is more dangerous than 230 V D.C Why?**

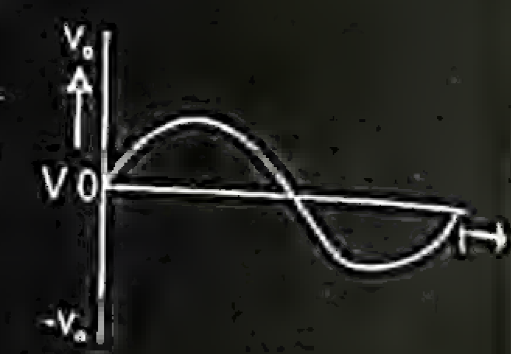
Ans. For 230 V A.C the peak value is 325.22V but 230V D.C has same maximum value, So A.C is more dangerous than D.C of the same voltage.

4. What are advantages of a three phase supply?

Ans. The important advantage of a three phase supply is that it can bear large load since it can generate voltage of about 400 V and load is divided into three parts. It can be used to operate some special appliances needed 400V for their working.

5. What is the average value of alternating voltage over a complete cycle?

Ans. The average value of alternating voltage over a complete cycle is zero



$$<V> = \frac{V_o + (-V_o)}{2} = 0$$

6. What do mean by root mean square value of voltage?

Ans. The root mean square value it is the effective value of ac. It produces the same heating effect in a resistor as produces by same amount of d.c.

The root mean square value (effective value) is obtained by taking the square root of $\frac{V_o^2}{2}$, therefore

$$V_{rms} = \sqrt{\frac{V_0^2}{2}} = \frac{V_o}{\sqrt{2}} = 0.707V_o,$$

Similarly $I_{rms} = 0.707I_o$

(Lhr 2007)

7. What do you think that the alternating current actually passes through the capacitor?

Ans. The alternating current flows because the capacitor plates are continuously charged, discharged and then again charged the other way round by alternating voltage.

8. What do you meant by reactance of the capacitor?

Ans. The opposition provided by a capacitor in the flow of a.c. is called capacitive reactance.

i.e. $X_c = \frac{1}{2\pi fC}$

9. Define impedance and write its unit.

Ans. The combined effects of resistances and reactances in an A.C circuit is known as impedance. It is denoted by 'Z' and $Z = \frac{V_{rms}}{I_{rms}}$. Its unit is Ohm (Ω).

(Grw 2005, Mtn 2005)

10. What do you meant by reactance of the inductor?

Ans. The opposition offered by a inductor in the flow of A.C is called inductive reactance which varies directly with frequency A.C.

i.e. $X_L = 2\pi fL$

11. What will be the net power loss through a pure capacitor or inductor? (Rwp 2006)

Ans. For a pure capacitor or inductor the phase change between voltage and current is 90°. So

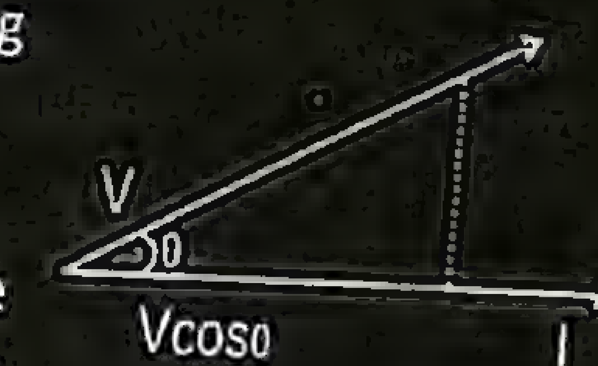
$$P = VI\cos\theta \qquad \text{As } \theta = 90°$$
$$= VI\cos 90°$$
$$= 0$$

Thus there will be no power loss through a pure capacitor or inductor over a completely. In that situation the wrest in social to wattles.

12. What do you meant by power factor for alternating circuit?

Ans. As for A.C phase of voltage and current may lead or lag so expression of power is

$$P = VI\cos\theta$$



Where cos θ is referred as power factor and can be defined as the ratio of the power consumed in an A.C to the power supplied to the circuit.

(Mir Pur 2006)

13. Why the RLC series circuit is also referred as acceptor circuit?

Ans. RLC series circuit is also referred as acceptor circuit because at resonance, the impedance become minimum and it will accept the maximum current and its impedance is maximum.

14. What do you meant by resonance frequency?

Ans. The frequency at which the capacitive and inductive reactances of the resonance circuit become equal is called resonance frequency. i.e. $X_c = X_L$

15. Does the resonance frequency depends upon the resistance of the circuit?

Ans. As $f_r = \frac{1}{2\pi\sqrt{LC}}$

As the formula of resonance frequency does not contain any term of resistance. So resonance frequency is independent of resistance.

16. Show that resonance frequency is given as

$f_r = \frac{1}{2\pi\sqrt{LC}}$

Ans. As condition for resonance is given by

$$X_L = X_C$$

where $X_L = \omega L$ and $X_c = \dfrac{1}{\omega c}$.

Thus $\omega_r L = \dfrac{1}{\omega_r c}$,

or $\omega_r^2 = \dfrac{1}{LC}$,

$\omega_r = \dfrac{1}{\sqrt{LC}}$, but $\omega_r = 2\pi f_r$

Thus $2\pi f_r = \dfrac{1}{\sqrt{LC}}$

or $f_r = \dfrac{1}{2\pi\sqrt{LC}}$ Hence proved

(Rwp 2005)

17. Write down the advantage to use the three phase A.C. supply?

Ans. i) The main advantage of three phase supply is that the whole load is divided into three parts so that none of the line is over loaded.

ii) The three phase supply gives 400V which can be used to operate some special appliances for their working.

18. Describe the principle of metal detector?

Ans. According to principle of metal detector:
Difference of frequencies of two electrical oscillators (LC circuits) caused by placing the metallic object near one of them results to produce the beats.

19. Give some uses of metal detector?

Ans. i) Metal detectors are used for various security checks.

ii) Metal detectors are used to locate buried metals.

20. What is the function of choke?

Ans. As it consists of coil of thick copper wire so it has low very low value of resistance and a very high value of mducatan i.e. It is used to limit the current in A.C circuits with very small wastage of energy as compared to a resistance or a rheostat.
(Lhr 2008)

21. Give some properties of electromagnetic waves?

Ans. (i) They are produced by oscillating electric and magnetic fields.

(ii) They don't required any medium for their propagation.

(iii) They travel in vacuum with speed 3×10^8. ms^{-1} (i.e. speed of light)

(iv) The formula for speed of electromagnetic wave is $c = f\lambda$

22. Is it possible to generate the electromagnetic waves from a stationary charge also describe the principle of generate?

Ans. No, because a static charge cause to produce the stationary electric field only. Even the steady current through the conductor also does not radiate in space. The only hence ι generate electro negative wave is that the charged particle should be acerbated.

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. If I_o is the peak value of an AC supply, then its rms value is given as I_{rms} = ______
(a) $\dfrac{I_o}{\sqrt{2}}$ (b) $\dfrac{I_o}{0.707}$ (c) $\sqrt{2}I_o$ (d) $\dfrac{I_o}{2}$

2. Resonating frequency of RLC series circuit is f_r = ______
(a) $\dfrac{I_o}{\sqrt{LC}}$ (b) $\dfrac{I_o}{2\pi}\sqrt{LC}$ (c) $\dfrac{1}{2\pi\sqrt{LC}}$ (d) $2\pi\sqrt{LC}$

3. A capacitor is perfect insulator for:
(a) Alternating current (b) Direct current
(c) Both A & B (d) None of these

4. In modulation, low frequency signal is known as:
(a) Loaded signal (b) Fluctuated signal
(c) Harmonic signal (d) Modulation signal

5. Pure choke consumes:
(a) Minimum power (b) Maximum power
(c) No power (d) Average power

6. Power dissipation in a pure inductive or in a pure capacitance circuit is:
(a) Infinite (b) Zero (c) Minimum (d) Maximum

7. In case of capacitor, the unit of reactance is

(a) farad (b) ohm (c) mho (d) henry

8. How many types of modulation is
(a) 1 (b) 2 (c) 3 (d) 4

9. The frequency of alternating current is
(a) $f=\sqrt{1/T}$ (b) f = T (c) f = 1/T (d) $f=1/\sqrt{T}$

10. An AC continuously flows through the plates of a capacitor due to
(a) charging of plates (b) discharging of plates
(c) dielectric medium (d) both charging and discharging

11. The peak value of an AC current I_o is given by
(a) $I_{rms}/2$ (b) $I_{rms}/\sqrt{2}$ (c) $2I_{rms}$ (d) $\sqrt{2}\,I_{rms}$

12. The sum of positive and negative peak values is usually written as
(a) p-n values (b) p-p values (c) rms values (d) cycle values

13. The rms value of emf in a circuit is given by a factor of
(a) 1.11 (b) 0.707 (c) 0.07 (d) 0.637

14. SI unit of impedance is
(a) henry (b) hertz (c) ohm (d) ampere

15. For series resonance circuit, the impedance of the circuit at resonance frequency is
(a) minimum (b) maximum (c) zero (d) one

16. The basic current element in a D.C circuit is
(a) an inductor (b) resistor (c) capacitor (d) battery

17. High frequency radio wave is called
(a) fluctuative wave (b) carrier wave (c) matter wave (d) energetic wa

18. The net reactance of a circuit is zero. The circuit may consist of
(a) inductor only (b) capacitor only
(c) both inductor and capacitor (d) none of these

19. The phase angle between the voltage and current through resistor is
(a) 0° (b) 45° (c) 180° (d) 270°

20. Electromagnetic waves emitted from antenna are
(a) transverse (b) longitudinal (c) stationary (d) all of these

Answers Key:

1.	(a) $\frac{I_o}{\sqrt{2}}$	11.	(d) $\sqrt{2}\,I_{rms}$
2.	(c) $\frac{1}{2\pi\sqrt{LC}}$	12.	(b) p-p values
3.	(b) Direct current	13.	(b) 0.707
4.	(d) Modulation signal	14.	(c) ohm
5.	(c) No power	15.	(a) minimum
6.	(b) Zero	16.	(b) resistor
7.	(b) ohm	17.	(b) carrier wave
8.	(b) 2	18.	(c) both inductor and capacitor
9.	(c) f = 1/T	19.	(a) 0°
10.	(d) both charging and discharging	20.	(a) transverse

Chapter 17

PHYSICS OF SOLIDS

Topic Wise MCQ's

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer:

Crystalline, Amphorous And Polymeric Solids Crystal Lattice

1. The branch of physics that deals with the nature and properties of matter in the solid state is called:
   (a) Particle physics (b) Nuclear physics
   (c) Solid state physics (d) Atomic physics
2. A element or compound that has definite shape and volume is called:
   (a) solid (b) liquid
   (c) gas (d) plasma
3. Materials have specific uses depending upon their characteristics and properties such as:
   (a) hardness (b) ductility
   (c) malleability (d) all of these
4. A solid having regular arrangement of molecules throughout its structure is called:
   (a) amorphous solid (b) amorphous
   (c) polymeric or glassy solid (d) crystalline solid
5. Molecules of solid possess:
   (a) vibrational motion (b) translatory motion
   (c) rotatory motion (d) circular motion
6. The neighbours of every molecule in crystalline solids are arranged in:
   (a) an irregular manner (b) a regular manner
   (c) either of these (d) none of these
7. Which of the following is a crystalline solid?
   (a) sodium chloride (b) copper
   (c) zirconia (d) all of these

8. **Arrangement of molecules in crystalline solids is studied by using:**
   (a) Laser technique (b) γ-rays technique
   (c) X-ray technique (d) all of these
9. **Sodium chloride exit in the form of:**
   (a) crystalline structure (b) amorphous structure
   (c) polymeric structure (d) all of these
10. **The atoms or molecules in a crystalline solids are held together by:**
   (a) cohesive force (b) adhesive force
   (c) attractive force (d) resistive force
11. **The molecules or ions in a crystalline solids are:**
   (a) not static (b) static
   (c) either of these (d) none of these
12. **The cohesive force between atoms, molecules or ions in crystalline solids maintain the strict:**
   (a) short range order (b) long range order
   (c) intermediate range order (d) none of these
13. **Every crystalline solid has:**
   (a) same melting point (b) different melting point
   (c) definite melting point (d) none of these
14. **The word amorphous means:**
   (a) with regular structure (b) without structure
   (c) either of these (d) none of these
15. **A solid in which there is no regular arrangement of molecules is called:**
   (a) Zirconia (b) crystalline solid
   (c) amorphous solid (d) none of these
16. **Amorphous solids are more like:**
   (a) gases (b) liquids in frozen
   (c) plasma (d) none of these
17. **Amorphous solids are also called as:**
   (a) crystalline solids (b) polymeric solids
   (c) glassy solids (d) none of these
18. **Ordinary glass, on heating gradually soften into a paste like state at almost:**
   (a) 600°C (b) 800°C
   (c) 500°C (d) 700°C
19. **Glassy solids have:**
   (a) same melting point (b) definite melting point
   (c) not definite melting point (d) none of these

20. **Amorphous solids are more similar to:**
   (a) liquids with the disordered structure frozen in
   (b) liquids with the ordered structure frozen in
   (c) either of these
   (d) none of these
21. **Glass is also known as:**
   (a) crystalline solid (b) polymeric solid
   (c) solid liquid (d) None of these
22. **A structure that is intermediate between solid and liquid is called:**
   (a) crystalline solid (b) amorphous solid
   (c) polymeric solid (d) glassy solid
23. **Synthetic materials belong to:**
   (a) crystalline solids (b) amorphous solids
   (c) glassy solids (d) polymeric solids
24. **Polymeric solids have:**
   (a) low specific gravity (b) high specific gravity
   (c) zero specific gravity (d) none of these
25. **Polymeric solids exhibit:**
   (a) good strength-to-weight ratio
   (b) weak strength-to-weight ratio
   (c) either of these
   (d) none of these
26. **Plastic and synthetic rubber are termed as:**
   (a) crystalline solids (b) amorphous solids
   (c) glassy solids (d) polymeric solids
27. **Which of the following is polymeric solid?**
   (a) polythene (b) polystyrene
   (c) nylon (d) all of these
28. **Artificial polymers are made by a chemical reaction known as:**
   (a) polarization (b) polymerization
   (c) crystallization (d) all of these
29. **Polymers may consists of:**
   (a) carbon with oxygen
   (b) carbon with hydrogen and oxygen
   (c) carbon with metallic or non-metallic elements
   (d) all of these
30. **Natural rubber has the formula:**

(a) $(C_2H_4)_n$ (b) $(C_3H_5)_n$
(c) $(C_4H_6)_n$ (d) $(C_5H_6)_n$

31. The smallest three dimensional basic structure in a crystalline solid is called:
(a) crystal lattice (b) super conductor
(c) perfect solid (d) unit cell

32. The whole structure obtained by the repetition of unit cell is known as:
(a) cubical crystal (b) crystal lattice
(c) either of these (d) none of these

33. Which of them is not a crystalline solid:
(a) Copper (b) sodium chloride
(c) Iron (d) natural rubber

Deformation In Solids, tress And Strain, Elastic Constants

34. The ability of any body to return to its original shape is called:
(a) elasticity (b) plasticity
(c) flexibility (d) rigidity

35. Deformation of body may be the change in its:
(a) length (b) volume
(c) shape (d) all of these

36. The force applied on unit area to produce any change in the shape, length or volume of a body is called:
(a) stress (b) strain
(c) elasticity (d) rigidity

37. The results of mechanical tests are usually expressed by
(a) Stress curve (b) Strain curve
(c) stress and strain graph (d) none of these

38. Stress is mathematically expressed as:
(a) $\sigma = \frac{A}{F}$ (b) $\sigma = \frac{F}{A}$
(c) $\sigma = F \times A$ (d) $\sigma = \frac{F}{A}$

39. SI unit of stress is:
(a) Pascal (b) $kg\,m^{-1}\,s^{-2}$
(c) Nm^{-2} (d) all of these

40. The dimensions of stress are:
(a) $[MLT^{-1}]$ (b) $[ML^{-1}T^{-2}]$
(c) $[ML^{-1}T^{-1}]$ (d) $[ML^{-2}T^{-1}]$

41. Force applied on a unit area of a crystal is called:
(a) stress (b) strain
(c) elasticity (d) plasticity

42. Nm^{-2} is called:
(a) ohm (b) ampere
(c) volt (d) Pascal

43. When a stress changes the length of a body, it is called:
(a) shear stress (b) volumetric stress
(c) tensile stress (d) both a and c

44. When a stress changes the volume of a body, it is called:
(a) shear stress (b) tensile stress
(c) volumetric stress (d) linear stress

45. When stress changes the shape of a body, it is called:
(a) shear stress (b) tensile stress
(c) compressional stress (d) volumetric stress

46. Any alternation produced in shapes, length or volume when a body is subjected to some external force is called:
(a) polymerization (b) polarization
(c) crystallization (d) deformation

47. A stress which changes one dimension only is called:
(a) compressive stress (b) tensile stress
(c) volumetric stress (d) shear stress

48. Measure of deformation of a solid when stress is applied to it, is called:
(a) stress (b) strain
(c) elasticity (d) force

49. Strain is the ratio of:
(a) force/area
(b) area/force
(c) change in length/original length
(d) original length/change in length

50. SI unit of strain is:
(a) pascal (b) dyne
(c) newton (d) no unit

51. SI unit of stress is same as that of:
(a) force (b) momentum
(c) pressure (d) length

52. The reciprocal of bulk modulus is called
(a) stress (b) plasticity
(c) elasticity (d) compressibility

53. The dimensions of strain are:
(a) $[MLT^{-1}]$ (b) $[ML^{-1}T^{-2}]$
(c) $[MLT^{-2}]$ (d) dimensionless

54. The strain produced due to tensile stress is called:
(a) tensile strain (b) shear strain
(c) linear strain (d) compressive strain

55. The strain produced due to compressive stress is called:
(a) tensile strain (b) shear strain
(c) volumetric strain (d) compressive strain

56. If $\Delta\ell$ is the change in length and ℓ is the original length, then strain can be defined as:
(a) $\varepsilon = \frac{\ell}{\Delta\ell}$ (b) $\varepsilon = \frac{\Delta\ell}{\ell}$
(c) $\varepsilon = \ell \times \Delta\ell$ (d) $\varepsilon = \frac{\Delta\ell}{\ell^2}$

57. Volumetric strain can be defined as:
(a) $V \times \Delta V$ (b) $\frac{V}{\Delta V}$
(c) $\frac{\Delta V}{V^2}$ (d) $\frac{\Delta V}{V}$

58. The angular deformation produced in a body is called:
(a) tensile strain (b) shear strain
(c) volumetric strain (d) compressive strain

59. The ratio of stress to strain is called:
(a) modulus of plasticity (b) modulus of viscosity
(c) modulus of elasticity (d) modulus of rigidity

60. The units of modulus of elasticity are the same as those of:
(a) stress (b) strain
(c) pressure (d) both a and b

61. The unit of modulus of elasticity is:
(a) ampere (b) coulomb

(c) newton (d) pascal

62. In case of linear deformation, the ratio of tensile stress to tensile strain is called:
(a) Shear modulus (b) Bulk modulus
(c) Young modulus (d) All of these

63. Young's modulus, mathematically can be written as:
(a) $Y = \frac{\Delta\ell/\ell}{F/A}$ (b) $Y = \frac{F/\Delta\ell}{\ell/A}$
(c) $Y = \frac{\Delta\ell/A}{F/\ell}$ (d) $Y = \frac{F/A}{\Delta\ell/\ell}$

64. The ratio of volumetric stress to volumetric strain is called:
(a) Shear modulus (b) Bulk modulus
(c) Young's modulus (d) Hook's modulus

65. Bulk modulus, mathematically can be written as:
(a) $K = \frac{F/A}{\Delta V/V}$ (b) $K = \frac{F/A}{\Delta\ell/\ell}$
(c) $K = \frac{F/A}{\tan\theta}$ (d) $K = \frac{\Delta V/V}{F/A}$

66. The ratio of shear stress to shear strain is called:
(a) Young's modulus (b) Shear modulus
(c) Bulk modulus (d) Linear modulus

67. Shear modulus, mathematically can be written as:
(a) $G = \frac{\tan\theta}{F/A}$ (b) $G = \frac{F/A}{\tan\theta}$
(c) $G = \frac{F/A}{\Delta\ell/\ell}$ (d) $G = \frac{F/A}{\Delta V/V}$

Elastic Limit And Yield Strength, Strain Energy In Deformed Materials

68. Stress varies linearly with strain with in ________ limit:
(a) plalstic (b) proportional
(c) both a and b (d) none

69. Stress required to produce a unit strain is called:
(a) unit stress (b) unit strain
(c) modulus of elasticity (d) deformation

70. Within elastic limit, strain is directly proportional to stress, is the statement of:
(a) Boyle's law (b) Charles' law
(c) Hook's law (d) None of these

71. If stress is increased beyond the elastic limit of the material, it becomes permanently changed, this behaviour is called:
(a) elasticity (b) plasticity
(c) UTS (d) all of these

72. The maximum stress which a body can bear is called:
(a) elastic stress (b) plastic stress
(c) UTS (d) yield strength

73. The value of stress beyond which the body is permanently deformed is called:
(a) maximum stress (b) shear stress
(c) yield stress (d) tensile stress

74. Such a deformation in which the body regains its original shape after the removal of applied stress is called:
(a) plastic deformation (b) elastic deformation
(c) UTS (d) yield strength

75. Under the elastic limit, the deformation produced in the material is:
(a) permanent (b) temporary
(c) either of these (d) none of these

76. The substances which undergo plastic deformation until they break are known as:
(a) plastic substances (b) elastic substances
(c) brittle substances (d) ductile substances

77. The substances which break just after the elastic limit is reached, are called:
(a) Ductile substances (b) Hard substances
(c) Soft substances (d) Brittle substances

78. Glass and high carbon steel are the examples of:
(a) ductile substances (b) brittle substances
(c) soft substances (d) hard substances

79. Lead, copper and wrought iron are examples of:
(a) soft substances (b) hard substances
(c) ductile substances (d) brittle substances

80. The strain energy stored in any length of wire due to action of stress appears as:
(a) K.E (b) P.E.
(c) gravitational energy (d) electrical energy

81. The strain energy in a deformed wire of length 'ℓ' acted upon a force 'F' can be graphically calculated by measuring:
(a) area under the graph (b) height of graphs
(c) length under the graph (d) all of these

82. The amount of strain energy stored in deformed stretched wire is equal to:
(a) $\frac{1}{2}\left(\frac{EA\times\ell_1}{L}\right)$ (b) $\frac{1}{2}\left(\frac{EA^2\times\ell_1}{L}\right)$
(c) $\frac{1}{2}\left(\frac{EA^2\times\ell_1^2}{L}\right)$ (d) $\frac{1}{2}\left(\frac{EA\times\ell_1^2}{L}\right)$

Electrical Properties Of Solids

83. Conductors have conductivities of the order of:
(a) $10^3(\Omega m)^{-1}$ (b) $10^5(\Omega m)^{-1}$
(c) $10^7(\Omega m)^{-1}$ (d) $10^9(\Omega m)^{-1}$

84. Insulators have conductivities ranging between:
(a) 10^{-4} to 10^{-5} $(\Omega m)^{-1}$ (b) 10^{-6} to 10^{-12} $(\Omega m)^{-1}$
(c) 10^{-8} to 10^{-16} $(\Omega m)^{-1}$ (d) 10^{-10} to 10^{-20} $(\Omega m)^{-1}$

85. Semi-conductor have conductivities of the order of:
(a) 10^{-4} to 10^{-2} $(\Omega m)^{-1}$ (b) 10^{-6} to 10^{-3} $(\Omega m)^{-1}$
(c) 10^{-6} to 10^{-4} $(\Omega m)^{-1}$ (d) 10^{-8} to 10^{-4} $(\Omega m)^{-1}$

86. Conduction band may be:
(a) empty (b) partially filled
(c) both a and b (d) none

87. The theory which explain the three types of metals, completely is:
(a) Bohr atomic model theory
(b) Rutherford atomic model theory
(c) Energy band theory
(d) All of these

88. The electrons in the outermost shell of an atom are called:
(a) free electrons (b) valence electrons
(c) either of these (d) none of these

89. The valance band of an atom in a solid:

(a) is always empty (b) is never empty
(c) may or may not be empty (d) none of these

90. The band above the valence band is called:
(a) forbidden band (b) conduction band
(c) empty band (d) none of these

91. A empty or partially filled band is called:
(a) valence band (b) forbidden band
(c) conduction band (d) Fermi band

92. The electrons occupying the conduction band are known as:
(a) free electrons (b) conduction electrons
(c) both (a) and (b) (d) none of these

93. The conduction band in a solid:
(a) may be empty (b) cannot be empty
(c) both a & b (d) always completely filled

94. The bands below the valence band are normally:
(a) empty (b) partially filled
(c) completely filled (d) none of these

95. The materials in which there are plenty of free electrons are called:
(a) conductors (b) insulators
(c) semi-conductors (d) none of these

96. The materials in which valence electrons are bound very tightly to their atoms are known as:
(a) conductors (b) insulators
(c) semi-conductors (d) none of these

97. The conduction band lies:
(a) below valence band (b) above the valence band
(c) between the valence band and conduction band (d) may be anywhere

98. The conduction band in insulator is:
(a) partially filled (b) completely filled
(c) empty (d) none of these

99. At 0 k, a piece of Ge or Si is a perfect:
(a) insulator (b) conductor

(c) semiconductor (d) none of these

100. A substance which has partially filled conduction band is called:
(a) semiconductor (b) conductor
(c) both a & b (d) none of these

101. For semi-conductors narrow forbidden energy gap between the conduction and valence bands of a conductor is of the order of:
(a) 5 eV (b) 1 eV
(c) 50 eV (d) 100 eV

102. The forbidden energy gap of an insulator is of the order of:
(a) 5 eV (b) 10 eV
(c) 0.5 eV (d) several eV

103. Conductors are those materials in which energy gap is:
(a) very large (b) very narrow
(c) zero (d) none of these

104. Insulators are those materials in which energy gap is:
(a) very large (b) very narrow
(c) either of these (d) none of these

105. The vacancy of electron in the valence band is known as:
(a) neutron (b) proton
(c) positron (d) hole

106. A moving hole in a diode behaves like a:
(a) negative charge carrier (b) positive charge carrier
(c) neutral (d) none of these

107. At room temperature, Ge or Si crystal becomes a:
(a) conductor (b) superconductor
(c) semiconductor (d) insulator

108. Which one of the following acts as a positive charge carrier in a semiconductor?
(a) proton (b) electron
(c) positron (d) holes

Intrinsic And Extrinsic Semi-Conductors, Electrical Conductions In Solids

109. A semiconductor in its extremely pure form is known as:
(a) intrinsic semiconductor (b) extrinsic semiconductor
(c) semiconductor diode (d) n-type semiconductor

110. Silicon and germanium in their pure form near 0K is
(a) a conductors (b) an insulators
(c) semiconductors (d) extrinsic semiconductors

111. The process of adding a small amount of impurity into the pure semiconductor material is called:
(a) mixing (b) doping
(c) dropping (d) radiating

112. The doped semiconductor materials are called:
(a) intrinsic semiconductors (b) extrinsic semiconductors
(c) n-type semiconductors (d) p-type semiconductors

113. In the doping process, the ratio of the doping atoms to the semiconductor atom is:
(a) 1 to 10^2 (b) 1 to 10^4
(c) 1 to 10^6 (d) 1 to 10^8

114. Semiconductor elements have atoms with:
(a) 3 valence electrons (b) 4 valence electrons
(c) 5 valence electrons (d) 6 valence electrons

115. A semiconductor formed by the addition of a pentavalent impurity is called:
(a) p-type semiconductor (b) n-type semiconductor
(c) transistor (d) diode

116. A semiconductor formed by the addition of a trivalent impurity is called:
(a) n-type semiconductor (b) p-type semiconductor
(c) intrinsic semiconductor (d) semiconductor diode

117. Which of the following is pentavalent impurity?
(a) bismuth (b) phosphorous
(c) boron (d) all of these

118. Which of the following is trivalent impurity?
(a) gallium (b) indium
(c) boron (d) all of these

119. A n-type semiconductor is obtained by doping germanium or silicon with:
(a) hexavalent impurity (b) tetravalent impurity
(c) trivalent impurity (d) pentavalent impurity

120. Conductivity of semiconductor increases by:
(a) the rise in temperature (b) the fall of temperature
(c) either of these (d) none of these

121. When a covalent bond is broken in a doped semiconductor:
(a) an electron is created (b) a hole is created
(c) a pair of electron and hole is created
(d) none of these

122. On doping, the conductivity of semiconductor:
(a) increases (b) decreases

(c) remains constant (d) none of these

123. In p-type substances, the majority carriers are:
(a) free electrons (b) neutrons
(c) positrons (d) holes

124. In p-type substances, the minority carriers are:
(a) free electrons (b) neutrons
(c) positrons (d) holes

125. In n-type substance, the majority carriers are:
(a) free electrons (b) neutrons
(c) positrons (d) holes

126. In n-type substance, the minority carriers are:
(a) electrons (b) neutrons
(c) positrons (d) holes

127. A p-type crystal is:
(a) positively charged (b) negatively charged
(c) neutral
(d) sometimes positively and sometimes negatively charged

128. A n-type crystal is:
(a) positively charged (b) negatively charged
(c) Neutral
(d) sometimes positively and sometimes negatively charged

129. A trivalent impurity is usually called:
(a) acceptor (b) donor
(c) rectifier (d) transistor

130. A pentavalent impurity is usually called:
(a) acceptor (b) donor
(c) rectifier (d) transistor

131. A pure semi-conductor behaves like an insulator at:
(a) 50°C (b) 100°C
(c) −150°C (d) absolute zero

132. In a semiconductor material, current flows due to:
(a) negative charges (b) positive charges
(c) both negative & positive charges (d) none of these

133. In a semiconductor material, the total current is due to flow of:
(a) holes (b) electrons
(c) both holes and electrons (d) none of these

134. A hole in a p-type semiconductor is:
(a) an excess electron (b) a missing electron
(c) missing atom (d) none of these

135. Which one of the following is not semiconductor?
(a) copper (b) silicon
(c) germanium (d) gallium arsenide

Superconductors

136. The materials whose resistivity becomes zero below a certain temperature are called:
(a) insulators (b) conductors
(c) semiconductors (d) super conductors

137. The temperature below which the resistivity of a superconductor falls to zero is called:
(a) absolute temperature (b) Kelvin temperature
(c) limiting temperature (d) critical temperature

138. The first superconductor was discovered in:
(a) 1831 (b) 1911
(c) 1960 (d) 1990

139. The first superconductor was discovered by:
(a) Einstein (b) J. J. Thomson
(c) Kmaerlingh Ornes (d) Faraday

140. The critical temperature of mercury is:
(a) 1.18 K (b) 4.2 K
(c) 3.72 K (d) 7.2 K

141. The critical temperature of aluminium is:
(a) 1.18 K (b) 4.2 K
(c) 3.72 K (d) 7.2 K

142. The critical temperature of tin is:
(a) 1.18 K (b) 4.2 K
(c) 3.72 K (d) 7.2 K

143. The critical temperature of lead is:
(a) 1.18 K (b) 4.2 K
(c) 3.72 K (d) 7.2 K

144. Aluminium, tin and lead are superconductors:
(a) high temperature
(b) low temperature

(c) intermediate temperature
(d) none of these

145. Yttrium barium copper oxide ($YBa_2Cu_3O_7$) can become superconductor at:
(a) 163 K (b) −110°C
(c) both (a) or (b) (d) none of these

146. The practical use of superconductors is:
(a) magnetic resonance
(b) magnetic levitation train
(c) powerful but small electric motors
(d) all of these

147. Any superconductor with critical temperature above 77K (boiling point of liquid nitrogen) is referred as:
(a) high temperature superconductor
(b) low temperature superconductor
(c) intermediate temperature superconductor
(d) none of these

Magnetic Properties Of Solids

148. The idea that all magnetic effects may be due to circulating currents was first held by:
(a) Neil Bohr (b) Ampere
(c) Faraday (d) Coulomb

149. The field produced by an electron is generated by its:
(a) orbital motion (b) spin motion
(c) both spin and orbital motion
(d) sometimes by orbital motion and sometimes by spin motion

150. The source of magnetism of an atom is the:
(a) neutrino (b) neutrons
(c) positrons (d) electrons

151. The magnetic fields produced by a bar magnet and a current carrying solenoid are:
(a) similar (b) different
(c) equal (d) none of these

152. An atom with a net resultant magnetic field is called:
(a) atomic magnet (b) bar magnet
(c) magnet dipole (d) all of these

153. The substances in which magnetic fields produced by orbital and spin motion support each other and the atom behaves like tiny magnet, are called:
(a) paramagnetic substances (b) diamagnetic substances
(c) ferromagnetic substances (d) all of these

154. The substances in which magnetic fields produced by orbital and spin motion of electrons add up to zero, are called:
(a) paramagnetic substances (b) diamagnetic substances
(c) ferromagnetic substances (d) all of these

155. The substances in which the atoms cooperate with each other in such a way to exhibit a strong magnetic effects is called:
(a) paramagnetic substances (b) diamagnetic substances
(c) ferromagnetic substances (d) all of these

156. Iron, cobalt and nickel are examples of:
(a) paramagnetic substances (b) diamagnetic substances
(c) ferromagnetic substances (d) all of these

157. Water, copper, bismuth and antimony are examples of:
(a) paramagnetic substances (b) diamagnetic substances
(c) ferromagnetic substances (d) all of these

158. The substances in which the atoms do not form magnetic dipoles are called:
(a) paramagnetic substances (b) diamagnetic substances
(c) ferromagnetic substances (d) all of these

159. A small macroscopic region of a substance containing about 10^{12} to 10^{16} atoms is called as:
(a) pole (b) crystal lattice
(c) domain (d) diode

160. Each domain of the order of millimetres of a certain substance might contain
(a) 10^{8} to 10^{12} atoms (b) 10^{10} to 10^{14} atoms
(c) 10^{12} to 10^{16} atoms (d) 10^{14} to 10^{18} atoms

161. Within each domain, the magnetic field of all the spinning electrons are:
(a) parallel (b) anti-parallel
(c) perpendicular (d) none of these

162. Each domain behaves like a:
(a) strong magnet (b) small magnet
(c) both a & c (d) none of these

163. A permanent magnet is made from a material which is:
(a) diamagnetic (b) ferromagnetic
(c) both a & b (d) all of these

164. Which one of the following can become a good permanent magnet?
(a) steel (b) iron
(c) both steel & iron (d) none of these

165. Which one of the following can become a good temporarily magnet:

(a) iron (b) steel
(c) either of these (d) none of these

166. The temperature at which the material loses its orderliness due to increase in thermal vibration is called:
(a) critical temperature (b) absolute temperature
(c) curie temperature (d) super temperature

167. The curie temperature for iron is about:
(a) 450°C (b) 550°C
(c) 650°C (d) 750°C

168. Above curie temperature, iron behaves as:
(a) paramagnetic (b) diamagnetic
(c) ferromagnetic (d) electromagnet

Hysteresis Loop

169. Magnetism lags behind the magnetizing current. This phenomenon is called:
(a) saturation (b) coercivity
(c) retentivity (d) hysteresis

170. The energy required to magnetize or demagnetize the material is called:
(a) coercivity (b) retentivity
(c) hysteresis loss (d) saturation

171. When the current is reduced to zero and the material remains magnetized, this property is called:
(a) coercivity (b) retentivity
(c) saturation (d) hysteresis

172. The negative value of current which reduces the magnetization to zero is called:
(a) electronic current (b) electric current
(c) coercive current (d) conventional current

173. The process in which magnetization reduces to zero by reversing the magnetizing current is called:
(a) coercivity (b) retentivity
(c) saturation (d) hysteresis

174. Large area of hysteresis loop shows:
(a) large wastage of energy (b) small wastage of energy
(c) no wastage of energy (d) none of these

175. Which is the most suitable material for making permanent magnet?
(a) iron (b) aluminium
(c) copper (d) steel

176. The retentivety of the steel is:

(a) More than the iron (b) less than the iron
(c) equal to the iron (d) none of these

177. **The energy dissipated per cycle for iron in hysteresis loop is:**
(a) more than the steel (b) less than the steel
(c) equal to the steel (d) none of these

178. **The instrument which helps in studying the process of hysteresis is:**
(a) mass spectrograph (b) Cavendish apparatus
(c) CRO (d) all of these

179. **A material with high retentivity and large coercivity is most useful to make:**
(a) a permanent magnet (b) an electromagnet
(c) both (a) and (b) (d) none of these

180. **Hysteresis curve is studied in terms of:**
(a) saturation (b) retantivity and coercivity
(c) area of the loop (d) all of these

Answer Key's

1.	(c) solid state physics	2.	(a) solid
3.	(d) all of these	4.	(d) crystalline solid
5.	(a) vibrational motion	6.	(b) a regular manner
7.	(d) all of these	8.	(c) X-rays technique
9.	(a) crystalline structure	10.	(a) cohesive force
11.	(a) not static	12.	(b) long range order
13.	(c) definite melting point	14.	(b) without structure
15.	(c) amorphous solid	16.	(b) liquids in frozen
17.	(c) glassy solids	18.	(b) 800ºC
19.	(c) not definite melting point	20.	(a) liquids with the disordered structure frozen in
21.	(c) solid liquid	22.	(c) polymeric solid
23.	(d) polymeric solids	24.	(a) low specific gravity
25.	(a) good strength-to-weight ratio	26.	(d) polymeric solids
27.	(d) all of these	28.	(b) polymerization
29.	(d) all of these	30.	(d) $(C_5H_8)_n$

31.	(d) unit cell	32.	(b) crystal lattice
33.	(d) natural rubber	34.	(a) elasticity
35.	(d) all of these	36.	(a) stress
37.	(c) stress and strain graph	38.	(b) $\sigma = \frac{F}{A}$
39.	(d) all of these	40.	(b) $[ML^{-1}T^{-1}]$
41.	(a) stress	42.	(d) Pascal
43.	(c) tensile stress	44.	(c) volumetric stress
45.	(a) shear stress	46.	(d) deformation
47.	(b) tensile stress	48.	(b) strain
49.	(c) change in length/original lenth	50.	(d) no unit
51.	(c) pressure	52.	(d) compressionty
53.	(d) dimensionless	54.	(a) tensile strain
55.	(c) volumetric strain	56.	(b) $\varepsilon = \frac{\Delta \ell}{\ell}$
57.	(d) $\frac{\Delta V}{V}$	58.	(b) share strain
59.	(c) modulus of elasticity	60.	(d) both a and b
61.	(d) Pascal	62.	(c) young modulus
63.	(d) $Y = \frac{F/A}{\Delta \ell / \ell}$	64.	(b) Bulk modulus
65.	(a) $K = \frac{F/A}{\Delta V / V}$	66.	(b) share modulus
67.	(b) $G = \frac{F/A}{\tan\theta}$	68.	(b) proportional
69.	(c) modulus of elasticity	70.	(c) Hook's law
71.	(b) plasticity	72.	(c) UTS
73.	(c) yield stress	74.	(b) elastic deformation
75.	(b) temporary	76.	(d) ductile substances
77.	(d) Brittle substances	78.	(b) brittle substances
79.	(c) ductile substances	80.	(b) P.E.

81.	(a) area under the graph	82.	(d) $\frac{1}{2}\left(\frac{EA\times \ell_1^2}{L}\right)$
83.	(c) $10^{7}(\Omega m)^{-1}$	84.	(d) 10^{-10} to $10^{-20}(\Omega m)^{-1}$
85.	(c) 10^{-6} to $10^{-4}(\Omega m)^{-1}$	86.	(c) both a and b
87.	(c) energy band theory	88.	(b) valence electrons
89.	(b) is never empty	90.	(b) conduction band
91.	(c) conduction band	92.	(c) both a and b
93.	(c) both a and b	94.	(c) completely filled
95.	(a) conductors	96.	(b) insulators
97.	(b) above the valence band	98.	(c) empty
99.	(a) insulator	100.	(c) both a and b
101.	(b) 1 eV	102.	(a) 5 eV
103.	(c) zero	104.	(a) very large
105.	(d) hole	106.	(b) positive charge carrier
107.	(c) semiconductor	108.	(d) holes
109.	(a) intrinsic semiconductor	110.	(b) an insulators
111.	(b) doping	112.	(b) extrinsic semiconductors
113.	(c) 1 to 10^{6}	114.	(b) 4 valence electrons
115.	(b) n-type semiconductor	116.	(b) p-type semiconductor
117.	(b) phosphorous	118.	(d) all of these
119.	(d) pentavalent impurity	120.	(a) the rise in temperature
121.	(c) a pair of electron and hole s created	122.	(a) increases
123.	(d) holes	124.	(a) free electrons
125.	(a) free electrons	126.	(d) holes
127.	(c) neutral	128.	(c) neutral
129.	(a) acceptor	130.	(b) donor
131.	(d) absolute zero	132.	(c) both negative and positive charges
133.	(c) both holes and electrons	134.	(b) a missing electron
135.	(a) copper	136.	(d) super conductors
137.	(d) critical temperature	138.	(b) 1911

139.	(c) Kmaerling Ornes	140.	(b) 4.2 K
141.	(a) 1.18 K	142.	(c) 3.72 K
143.	(d) 7.2 K	144.	(b) low temperature
145.	(c) both a and b	146.	(d) all of these
147.	(a) high temperature superconductor	148.	(b) Ampere
149.	(c) both spin and orbital motion	150.	(d) electrons
151.	(a) similar	152.	(a) atomic magnet
153.	(a) paramagnetic substances	154.	(b) diamagnetic substances
155.	(c) ferromagnetic substances	156.	(c) ferromagnetic substances
157.	(b) diamagnetic substances	158.	(b) diamagnetic substances
159.	(c) domain	160.	(c) 10^{12} to 10^{15} atoms
161.	(a) parallel	162.	(b) small magnet
163.	(b) ferromagnetic	164.	(a) steel
165.	(a) iron	166.	(c) curie temperature
167.	(d) 750ºC	168.	(a) paramagnetic
169.	(d) hysteresis	170.	(c) hysteresis loss
171.	(b) retentivity	172.	(c) coercive current
173.	(a) coercivity	174.	(a) large wastage of energy
175.	(d) steel	176.	(b) less than the iron
177.	(b) less than the steel	178.	(c) CRO
179.	(a) a permanent magnet	180.	(d) all of these

Brain Teasing MCQ's (with Hints)

Four possible answers to each statement are given below. Tick (✓) the correct answer:

1. A body which does not undergo any deformation when subjected to set of balanced force is called
   (a) a plastic body (b) a rigid body

(c) an elastic body (d) an isotropic body

2. The substance which shows practically no elastic after effect is:
(a) quartz (b) steel
(c) copper (d) rubber

3. Which of the following substance has heighest elasticity?
(a) rubber (b) copper
(c) brass (d) steel

4. A steel wire is loaded by a 2 kg mass. If the radius of wire is doubled, its extension will become
(a) double (b) half
(c) one fourth (d) one eight

5. The breaking stress of a material is defined as
(a) total breaking load (b) breaking load per unit area
(c) breaking load per unit length (d) breaking load per unit volume

6. A cable is shortened to half its length. The maximum load it can support without exceeding its elastic limit is
(a) doubled (b) halved
(c) does not change (d) None of these

7. The modulus of rigidity of a liquid is
(a) zero (b) 1
(c) infinity (d) none of these

8. The fractional change in volume per unit increase in pressure is called
(a) pressure coefficient (b) volume co-efficient
(c) bulk modulus (d) compressibility

9. A wire can support a load w without breaking. It is cut into two equal parts. The maximum load that each part can support is
(a) $\frac{W}{4}$ (b) $\frac{W}{2}$
(c) W (d) 2W

10. Energy per unit volume of a stretched wire is
(a) $\frac{1}{2}$(load)(extension) (b) load × stress
(c) stress × strain (d) $\frac{1}{2}$(stress)(strain)

11. Which of the following is the bonding in a germanium crystal?

(a) ionic (b) covalent
(c) metallic (d) Vander waals

12. With rise in temperature, the specific resistance of a semiconductor
(a) remains unchanged (b) increases
(c) decreases (d) first decreases and then increases

13. When the conductivity of a semiconductor is only due to the breaking of the covalent bonds, the semiconductor is called
(a) doner (b) accepter
(c) intrinsic (d) extrinsic

14. If the tensile force is suddenly removed from a wire then its temperature will
(a) increase (b) decrease
(c) remain constant (d) None of above

15. The modulus of elasticity of a material does not depend upon
(a) Shape (b) nature of material
(c) temperature (d) impurity mixed

16. The area under hysteresis loop is proportional to
(a) magnetic energy density (b) thermal energy per unit volume
(c) electrical energy per unit volume (d) mechanical energy per unit volume

17. If a magnetic material is beaten with a hammer then its magnetism
(a) increases (b) decreases
(c) get spoiled (d) None of these

18. When a magnet is heated it
(a) gains magnetism (b) loses its magnetism
(c) neither gain nor loses magnetism (d) None of these

19. A freely suspended bar magnet oscillates with a period T. If it is cut into two equal parts parallel to its length, the time period of each part will be
(a) T (b) $\frac{T}{2}$
(c) $\frac{T}{4}$ (d) $\frac{T}{8}$

20. Demagnetisation of a magnet can be done by
(a) hammering it (b) heating it
(c) magnetising in the opposite direction (d) All of above

21. All the magnetic materials lose their magnetic properties when
(a) dipped in water (b) dipped in oil

(c) strongly heated (d) All of these

22. The material of a permanent magnet has
(a) high retentivity, low coercivity (b) low retentivity, high coercivity
(c) low retentivity, low coercivity (d) high retentivity, high coercivity

Answer with Hints

No.	Correct Option	Answers	Hint
1	b	a rigid body	
2	a	quartz	
3	d	steel	
4	c	one forth	$\Delta L = \frac{FL}{Ay}$ radius doubled area increases four time
5	b	breaking load per unit area	
6	c	does not change	
7	a	zero	
8	d	compressibility	
9	c	W	
10	d	$\frac{1}{2}$(stress)(strain)	
11	b	Covalent	
12	c	decreases	
13	c	intrinsic	
14	a	increase	
15	a	shape	
16	b	Thermal energy per unit volume	
17	c	get spoiled	
18	b	loses its magnetism	
19	a	T	
20	d	All of above	
21	c	strongly heated	
22	d	high retentivity, high coercivity	

Additional Short Questions

1. **Which is more elastic, steel or rubber? Why?**

Ans. Steel. Because, modulus of rigidity = $\frac{\text{stress}}{\text{strain}}$ ..Consider a steel and rubber wire of equal lengths and equal cross-section areas. If the same force is applied to both, then strain of rubber is more. i.e., its elasticity is less or steel is more elastic.

2. **A spring is made of steel and not of copper; why?**

Ans. Young's modulus of steel is more. Within the elastic limit, steel can bear larger tension. Also steel recovers its original state quickly.

3. **Why does a paramagnetic sample display greater magnetization (for the same magnetizing field) when cooled?**

Ans. At low temperature the random thermal motion which disrupts the alignment of dipoles is reduced and hence the paramagnetic sample displays magnetization to a greater degree.

4. **Define solid state physics?**

Ans. The branch of physics concerned with the study of structure and properties of solids is known as solid state physics.

5. **Why the amorphous solids or glassy solids are referred as solid liquids?**

Ans. Amorphous solids or glassy solids are referred as solid liquids, because amorphous solids are more like liquids with the disordered structure frozen in.

6. **How the polymers are formed?**

Ans. Polymers are formed by a process called polymerization.

Polymerization: The process in which relatively simple molecules are combined into massive long chain molecules or three dimentional structure by some chemical reactions is called polymerization.

7. What is unit cell in crystalline solids?

Ans. A crystalline solid consists of three dimensional pattern that repeat itself over and over again.

"The smallest three dimensional basic structure is called unit cell."

(Lhr 2005)

8. What do you understand by crystal lattice?

Ans. A crystallalline structure which is built up by the repetition of a unit cell is called crystal lattice.

e.g. NaCl, which has cubic shape, cubic crystals have all the sides meet at right angles.

9. What is meant by elasticity?

Ans. The ability of a certain body to return to its original shape after the removal of external force is called elasticity.

10. What is difference between elastic deformation and plastic deformation?

Ans. A temporary deformation is called an elastic deformation while a permanent deformation produced in some body is called as plastic deformation.

11. State Hooks law?

Ans. Hook's law can be stated as,

"Within elastic limit, stress is directly proportional to strain." Mathematically,

$$\text{stress} \propto \text{strain}$$

or. $$\text{Stress} = \text{constant (strain)}$$

Elastic limit: It is defined as the greatest stress that a material can bear without any permanent change in shape or dimension.

12. What is meant by yield stress?

Ans. The point on the curve beyond which if stress is increased, permanent deformation occurs in material is called yield point and stress at that point is called yield stress.

13. Differentiate between ductile and brittle substances?

Ans. **Ductile Substances:** Substances which undergo plastic deformation until they break are called ductile substances. e.g. lead, copper and wrought iron are ductile.

Brittle substances: Substances which break just after the elastic limit is reached are called brittle substances. e.g. glass and high carbon steel are brittle.

14. How will you differentiate between conductors, insulators and semi-conductors?

Ans. **Conductors:**

Those substances which have plenty of free electrons for electrical conduction are called conductors.

e.g. metals like copper, gold, silver etc.

Conductors can conduct electricity within a conductivity order of $10^7\ (\Omega m)^{-1}$

Insulators:

Those substances which have valence electrons tightly bound to their atoms are called insulators.

e.g. wood, glass, plastic, mica etc.

Insulators can conduct electricity within a conductivity order of 10^{-10} to 10^{-20} $(\Omega m)^{-1}$

Semi-conductors:

Those substances which have intermediate range of conductivities are called semi-conductors. e.g. Germanium and silicon

Semi-conductors can conduct electricity within conductivity order of 10^{-6} to $10^{-4} (\Omega m)^{-1}$

15. How the conductivity of semi-conductor diode can be raised?

Ans. The conductivity of semi-conductor diode can be raised by the increase of temperature of semi-conductor diode, because it causes to increase the number of charge carries by breaking of covalent bond.

16. Differentiate between N-type and P-type substances.

Ans. **N-Type Substances:** A single crystal of silicon or germanium formed after the addition of pentavalent substance is called N-type substance

P-Type Substance: A single crystal of silicon or germanium formed after the addition of trivalent substance is called P-type substance.

17. How will you differentiate between intrinsic and extrinsic semi-conductors?

Ans. **Intrinsic semi-conductor:** A semi-conductor in its extremely pure form is called intrinsic semi-conductor. Pure elemental silicon and germanium are intrinsic semi-conductors.

Extrinic semi-conductors: An impure form of semi-conductor material is called the extrinsic semi-conductor. Extrinsic semi-conductor is obtained by a process called doping.

(Grw 2005, Lhr 2004, D.G.Khan 2004)

18. **Why the intrinsic semiconductors behave like an insulator nearly at absolute zero?**

Ans. Intrinsic semi-conductors behave like an insulator nearly at absolute zero (i.e. 0K) because at absolute zero, there are no electrons in the conduction band and their valence band is completely filled. Thus at 0K, a piece of Ge or Si is a perfect insulator.

19. **What is meant by doping?**

Ans. The process of adding the small impurity atom in a pure semi-conductor by controlling way is called doping. Doping ratio is 1:10^6

20. **Why the trivalent impurity is known as acceptor impurity?**

Ans. An atom belonging to third group (like Ga, In) has three valence electrons. When it is added to fourth group (Ge or Si) having four electrons in their outer most orbit, then three electrons of Ga form the covalent bond with Ge or Si atoms, while there is one missing electron in the covalent bond with the fourth neighbouring Si or Ge atom, thus it can accept a valence electron, so trivalent impurity is known as accepter impurity.

21. **Why the pentavalent impurity is known as donor impurity?**

Ans. An atom belonging to 5th group (like P, Ar) has five valence electrons. When it is added to fourth group (Ge or Si) having four electrons in their outermost orbit. Then four electrons of P form the covalent bond with Si or Ge, while the fifth valence electron provides a free electrons which can be donated, the pentavalent impurity is also known as donor impurity.

22. **What are majority and minority charge carriers?**

Ans. There are two kinds of charge carriers in semi-conductors, a free electron and a hole.

In case of N-type semi-conductor, it has a large number of free electrons as negative charges carrier which are known as majority charge carriers whereas holes in it will be known as minority charge carriers.

In case of P-type semi-conductor, it has a large number of holes as positive charge carrier which are known as majority charge carriers whereas electrons in it will be known as minority charge carriers.

23. **What are super conductors and what is critical temperature?**

Ans. **Super conductors:** The conductor with zero electrical resistance at a certain temperature are called super-conductors.

Critical temperature: The temperature at which the resistance or resistivity becomes zero is called critical temperature.

(Lhr 2004-2008-2009, Sgd 2006, Rwp 2007, D.G.Khan 2007, Bwp 2007)

24. **What do you mean by high temperature super-conductor?**

Ans. The super-conductors with a critical temperature above 77K (i.e. the boiling point of liquid nitrogen) are called high temperature super- conductors.

25. **Give some uses of super conductors?**

Ans. Super-conductor have many technological applications such as

(i) Magnetic resonance imaging (MRI)
(ii) Magnetic levitation trains.
(iii) Powerful and small electric motors
(iv) Fast computer chips.

26. **Explain the responsible factors for magnetic field produced due to an atom?**

Ans. The magnetism is produced by electrons within an atom due to their two types of motions i.e. orbital motion and spin motion.

(i) **Orbital motions:** Each electron orbiting the nucleus behaves like an atomic sized loop or current that produces a small magnetic field.
(ii) **Spinning motion:** Each electron possesses a spinning motion which give rise to magnetic field.

27. **What are hard and soft magnetic materials?**

Ans. **Hard magnetic materials:** These are the substances in which their domains cannot be easily oriented on applying the external magnetic field. But once the domains are lined up by a very strong external magnetic field, they will retain their position after the removal of external field. These materials are used to make permanent magnet. e.g. steel and special alloy, called Alnico V.

Soft Magnetic materials: These are the materials in which their domains can be easily oriented on applying an external magnetic field and also return to original position when field is removed. Iron is called soft magnetic material. These are used for electromagnet.

28. **What is meant by curie temperature of a ferromagnetic material?**

Ans. The temperature above which a ferromagnetic substance becomes paramagnetic is called curie temperature.

The curie temperature, for iron is about 750°C.

29. **What is hysteresis cycle?**

Ans. A cycle of magnetizing field variations to which initially demagnetized ferromagnetic substance is subjected known as hysteresis cycle.

30. **What does hysteresis area of a ferromagnetic material represents?**

Ans. The area of the loop is a measure of the energy needed to magnetize and demagnetize each cycle. This is the energy required to do work against internal friction of the domains.

31. Coercivity of steel is more than iron. Why?

Ans. As more current is required to demagnetize steel than iron, so coercivity of steel is more than iron.
(Federal 2005)

32. Energy dissipated per cycle for steel is more as compared to iron. Why?

Ans. The area of the loop is a measure of the energy needed to magnetize and demagnetized each cycle.

As area of the loop for steel is large as compared to iron, so energy loss (dissipated) per cycle for steel is more than for iron. (Federal 2005)

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. Which type of solids have definite melting point
   (a) crystalline solids (b) amorphous solids
   (c) both (a) & (b) (d) none of these
2. Dimensions of strain are:
   (a) L^2 (b) L^{-2} (c) $ML^{-1}T^{-2}$ (d) no dimensions
3. When a silicon crystal is doped with a pentavalent element, it becomes
   (a) p-type semiconductor (b) n-type semiconductor
   (c) intrinsic semiconductor (d) extrinsic semiconductor
4. Substances which break just after the elastic limit is reached are called:
   (a) Ductile substances (b) Hard substances
   (c) Soft substances (d) Brittle substances
5. The substances in which the atoms do not form magnetic dipole are called:
   (a) Ferromagnetic (b) Paramagnetic (c) Diamagnetic (d) Conductor
6. Curie temperature of iron is:
   (a) 0 K (b) 570 K (c) 1023 K (d) 378 K

7. Reciprocal of bulk modulus is:
   (a) Elasticity (b) Young modulus
   (c) Compressibility (d) Shear modulus
8. The atoms, ions and molecules of crystalline materials maintain their long range order due to
   (a) adhesive force (b) cohesive force
   (c) electrostatic force (d) Van der Waal's force
9. The magnetism produced by electrons within an atom is due to
   (a) spin motion (b) orbital motion
   (c) spin and orbital motion (d) vibratory motion
10. The substance which have partially filled conduction band are called
   (a) insulator (b) semiconductor
   (c) conductor (d) super conductor
11. Nm^{-2} is called
   (a) ohm (b) ampere (c) volt (d) pascal
12. Which of the following is an example of ductile substance
   (a) lead (b) copper (c) glass (d) both (a) & (b)
13. Substance which break just after the elastic limit is reached are called
   (a) poor substance (b) ductile substance
   (c) brittle substance (d) soft substance
14. The materials whose resistivity becomes zero below a certain temperature are called
   (a) good conductor (b) semiconductor
   (c) super conductors (d) insulators
15. The temperature below which some materials show super conductivity is called
   (a) super temperature (b) critical temperature
   (c) absolute zero temperature (d) Kelvin temperature
16. What type of impurity is to be added to a pure semiconductor crystal to provide holes
   (a) monovalent (b) trivalent (c) tetravalent (d) pentavalent
17. Glass and high carbon steel are examples of
   (a) ductile substance (b) brittle substance
   (c) soft material (d) hard material
18. In n type materials, the minority carriers are
   (a) free electrons (b) holes (c) protons (d) mesons

Answers Key:

1.	(a) crystalline solids	10.	(c) spin and orbital motion
2.	(d) none of these	11.	(b) semiconductor
3.	(d) no dimensions	12.	(d) pascal
4.	(b) n-type semiconductor	13.	(d) both (a) & (b)
5.	(d) Brittle substances	14.	(c) brittle substance
6.	(c) Diamagnetic	15.	(c) super conductors
7.	(c) 1023 K	16.	(b) trivalent
8.	(c) Compressibility	17.	(b) trivalent
9.	(b) cohesive force	18.	(b) holes

Chapter 18 ELECTRONICS

Topic Wise MCQ's

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer:

p – n Junction And Its Characteristics

1. The branch of physics which deals with electrons and their controlled flow through various semi conductors devices is called:
   (a) electrostatics (b) electricity
   (c) electronics (d) electromagnetism
2. Semi-conductor materials in periodic table are located in:
   (a) second group (b) third group
   (c) fourth group (d) fifth group
3. The number of valence electrons in Si or Ge are:
   (a) 4 (b) 6
   (c) 8 (d) 2
4. In p-type substances majority charge carriers are:
   (a) electrons (b) protons
   (c) positron (d) holes
5. In n-type substances majority charge carriers are:
   (a) free electrons (b) protons
   (c) positrons (d) holes
6. The most commonly used semi-conductor is:
   (a) silicon (b) germanium
   (c) both silicon and germanium (d) none of these
7. Holes can exist in:
   (a) conductors (b) insulators
   (c) semi-conductor (d) all of these
8. p-type and n-type substances are joined together to give rise:

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   (c) semi-conductor (d) all of these
8. p-type and n-type substances are joined together to give rise:

(a) p-p junction (b) p-n junction
(c) semiconductor diode (d) both (b) and (c)

9. Whenever a p-n junction is formed, a chargeless region is formed around the junction, which is called as:
(a) field free region (b) p-region
(c) n-region (d) depletion region

10. Depletion region chargé carries:
(a) positive charge carrier (b) negative charge carrier
(c) both (a) and (b) (d) no charge carrier

11. The value of potential barrier (potential difference) for germanium (Ge) at room temperature is:
(a) 0.3V (b) 0.5V
(c) 0.7V (d) 0.9V

12. The value of potential barrier for silicon at room temperature is:
(a) 0.3V (b) 0.5V
(c) 0.7V (d) 0.9V

13. The depletion region is due to:
(a) forward biasing (b) reverse biasing
(c) absence of charge carriers (d) none of these

14. The potential difference setup across the depletion region is called:
(a) absolute potential (b) reverse potential
(c) gravitational potential (d) potential barrier

15. Potential barrier in a diode:
(a) helps in moving electrons from n-type to p-type
(b) helps in moving holes from p-type to n-type
(c) stops the mutual movement of both holes and electrons
(d) none of these

16. In p-n junction if p-side is at positive potential and n-side is at negative potential, then this junction is said to be:
(a) forward biased (b) reverse biased
(c) positively biased (d) negatively biased

17. In p-n junction if p-side is at negative potential and n-side is at positive potential, then this junction is said to be:
(a) forward biased (b) reverse biased
(c) positively biased (d) negatively biased

18. When the p-n junction is forward biased its resistance is in:
(a) kilo ohms (b) mega ohms

(c) few ohms (d) none ot these

19. When the p-n junction is forward biased, current flows through it is of the order of:
(a) nano-amperes (b) milli-amperes
(c) amperes (d) micro-amperes

20. In forward biased start, a p-n junction offers:
(a) low resistance (b) high resistance
(c) zero resistance (d) infinite resistance

21. A reverse p-n junction can act as:
(a) resistor (b) cell
(c) inductor (d) conductor

22. When the p-n junction is reverse biased, its resistance is of the order of:
(a) kilo ohms (b) mega ohms
(c) few ohms (d) micro ohms

23. When the p-n junction is reverse biased, current flows through it, is of the order of:
(a) milli-amperes (b) micro-amperes
(c) nano-amperes (d) amperes

24. In reverse biased stale an ideal p-n junction offers:
(a) Low resistance (b) infinite resistance
(c) zero resistance (d) very high resistance

25. When the p-n junction is forward biased, current flows through the junction due to
(a) minority charge carriers (b) majority charge carriers
(c) both minority and majority carriers
(d) none of these

26. The reverse current in a p-n junction flows due to:
(a) holes (b) electrons
(c) majority carriers (d) minority charge carriers

27. The forward resistance of the p-n junction is expressed as:
(a) $r_f = \dfrac{\Delta V_f}{\Delta I_f}$ (b) $r_f = \dfrac{\Delta I_f}{\Delta V_f}$
(c) $r_f = \Delta I_f \times \Delta V_f$ (d) $r_f = \Delta V_f - \Delta V_i$

28. A diode characteristics curve is a plot between:
(a) current and resistance (b) voltage and time
(c) voltage and current (d) current and time

29. If reverse current of a reverse biased junction is increased to a maximum value then:
(a) diode becomes more efficient
(b) voltage drop to zero

(c) diode junction will break down
(d) none of these

30. When a p-n junction is reverse biased, the depletion region is:
(a) widened (b) narrowed
(c) normal (d) none of these

31. A diode cannot be used as:
(a) an amplifier (b) a detector
(c) a rectifier (d) All of these

32. In semi-conductor diode, p-type end is usually referred as:
(a) cathode (b) anode
(c) neutral
(d) sometimes negative and sometimes positive

33. The number of terminals in a semi-conductor diode is:
(a) 2 (b) 3
(c) 4 (d) 5

Rectification, Specially Designed P-n Junction

34. The process of converting an alternating current (A.C) into a direct current (D.C) is known as:
(a) magnification (b) rectification
(c) amplification (d) purification

35. Rectification is done by:
(a) capacitor (b) inductor
(c) transformer (d) diode

36. Conversion of only one half of an A.C. into D.C. is called:
(a) half wave amplification (b) full wave amplification
(c) half wave rectification (d) full wave rectification

37. In a half wave rectifier, the diode conducts:
(a) a portion of a +ve half of an input cycle
(b) a portion of a –ve half of an input cycle
(c) both halves of an input cycle
(d) one half of the input cycle

38. The output voltage of a rectifier is:
(a) sawtooth (b) smooth
(c) pulsating (d) none of these

39. By rectification process the current received across the load resistance R is:
(a) A.C. (b) D.C.
(c) either of these (d) none of these

40. During the negative half-cycle of the rectification process, the diode is said to behave as:
(a) forward biased (b) reverse biased
(c) neither forward nor reverse biased
(d) none of these

41. In full wave rectification by bridge, the number of diodes required are:
(a) only one (b) two
(c) three (d) four

42. Rectification process needs:
(a) AC source + load
(b) AC source + load + diode only
(c) AC source + load + diode + transformer
(d) diode + load only

43. In full wave rectification:
(a) only one half of the input voltage is used
(b) both halves of the input voltage are used
(c) only negative half cycle is used
(d) none of these

44. The circuit which is used to smooth the output voltage of the full wave rectifier is known as:
(a) Generator (b) transformer
(c) Filter (d) choke

45. p-n junction after some development can be used as:
(a) light emitting diode (b) photodiode
(c) photo voltaic cell (d) all of these

46. LED works on the basis of:
(a) emission of energy in the form of photons
(b) Faraday's law of electromagnetic induction
(c) Einstein's theory of relativity
(d) photoelectric effect

47. Light emitting diodes (LED) are made from special semi-conductors such as:
(a) gallium arsenide (b) gallium arsenide phosphide
(c) gallium phosphide (d) all of these

48. The colour of light emitted by a LED depends on:
(a) its forward bias (b) its reverse bias
(c) the amount of forward current
(d) the type of semiconductor material used

49. Which one of the following diode is used for detection of light?
(a) light emitting diode (b) photodiode
(c) photovoltaic cell (d) all of these

50. Photodiodes can be used:
(a) for detecting of light (b) automating switching
(c) logic circuits and optical communication devices
(d) all of these

51. Photodiode is always connected in:
(a) reverse biased (b) forward biased
(c) either of these (d) none of these

52. Photovoltaic cell converts:
(a) light energy into mechanical energy
(b) light energy into heat energy
(c) light energy into electrical energy
(d) light energy into nuclear energy

53. Photovoltaic cell is formed from:
(a) germanium (b) silicon
(c) arsenic (d) antimony

54. In photovoltaic cell, current is directly proportional to the:
(a) intensity of light (b) frequency of light
(c) wavelength of light (d) all of these

55. A single silicon photovoltaic cell produces a small voltage of
(a) 0.2V (b) 0.4V
(c) 0.6V (d) 0.8

56. Photovoltaic panels are generally used in:
(a) satellites (b) generators
(c) transformers (d) amplifiers

57. A single silicon photovoltaic cell produces a current of the order of:
(a) 10^{-2} A (b) 10^{-3} A
(c) 10^{-4} A (d) a few milli amperes

58. A photo-diode can switch its current ON and OFF in:
(a) pico-seconds (b) micro-seconds
(c) nano-seconds (d) milli-seconds

Transistors, Transistor As An Amplifier Transistor As A Switch

59. When an n-type material is sandwiched between two p-type materials, then the transistor is called:
(a) n-p-n transistor (b) p-n-p transistor

(c) either of these (d) none of these

60. When a p-type material is sandwiched between two n-type materials, then the transistor is called:
(a) n-p-n transistor (b) p-n-p transistor
(c) either of these (d) none of these

61. A transistor is a combination of:
(a) two back to back p-n junctions
(b) three back to back p-n junctions
(c) four back to back p-n junction
(d) none of these

62. Transistors are made from:
(a) plastics (b) metals
(c) insulators (d) doped semi-conductors

63. The central region of the transistor is known as:
(a) emitter (b) collector
(c) base (d) depletion region

64. For the normal operation of transistor, the emitter base junction is always:
(a) forward biased (b) reverse biased
(c) open (d) none of these

65. For the normal operation of transistor, the collector-base junction is always:
(a) forward biased (b) reverse biased
(c) open (d) none of these

66. In p-n-p transistor, the current flows in the direction from:
(a) emitter to collector (b) emitter to base
(c) base to emitter (d) base to collector

67. In n-p-n transistor, the current flows in the direction from:
(a) emitter to base (b) emitter to collector
(c) base to emitter (d) base to collector

68. In transistor, which one is very thin?
(a) emitter (b) base
(c) collector (d) all are of same size

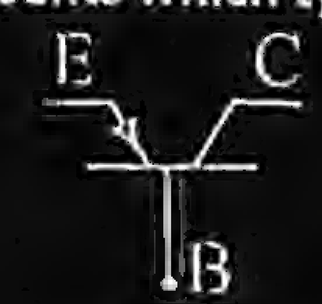
69. The thickness of the base is of the order of:
(a) 10^{-2} m (b) 10^{-4} m
(c) 10^{-6} m (d) 10^{-8} m

70. Which component of the transistor has greater concentration of impurity?
(a) emitter (b) base
(c) collector (d) none of these

71. For normal operation of transistor, the battery:
 (a) V_{CC} is much higher than V_{BB}
 (b) V_{CC} is much smaller than V_{BB}
 (c) V_{CC} is equal to V_{BB}
 (d) none of these

72. In general most of the electrical circuits make use of:
 (a) p-n-p transistor (b) n-p-n transistor
 (c) either of these (d) none of these

73. The symbol given in the figure represents which type of transistor?



 (a) p-n-p transistor (b) n-p-n transistor
 (c) both (a) and (b) (d) none of these

74. The symbol in the figure represents which type of transistor:

 (a) p-n-p transistor (b) n-p-n transistor
 (c) both p-n-p and n-p-n transistor
 (d) none of these

75. The fundamental equation for all transistor are:
 (a) $I_E = I_C + I_B$ (b) $\beta = \frac{I_C}{I_B}$
 (c) both (a) and (b) (d) none of these

76. The current gain 'β' of a transistor for CE –transistor is given by:
 (a) $\beta = \frac{I_B}{I_C}$ (b) $\beta = \frac{I_C}{I_B}$
 (c) $\beta = \frac{I_C}{I_E}$ (d) $\beta = \frac{I_E}{I_C}$

77. The value of current gain of n-p-n transistor is of the order of:
 (a) tens (b) hundreds
 (c) thousands (d) none of these

78. In a certain circuit, the transistor has a collector current of 10 mA and a base current of 40 μA. Then the current gain of the transistor is:
 (a) 0.25 (b) 400

 (c) 250 (d) 100

79. Transistor was discovered by:
 (a) Young (b) Curie
 (c) John Bardeen (d) Shales

80. Which one of the following is the most important building block of any complex electronic circuit?
 (a) oscillator (b) amplifier
 (c) rectifier (d) transistor

81. The voltage gain of an amplifier is written as:
 (a) $\frac{V_{out}}{V_{in}}$ (b) $\frac{V_{in}}{V_{out}}$
 (c) $V_{in} \times V_{out}$ (d) $\frac{V_{in}}{I_{out}}$

82. Conversion of low AC voltage into high AC voltage is called:
 (a) rectification (b) magnification
 (c) amplification (d) all of these

83. The voltage gain of the common emitter n-p-n transistor as an amplifier is:
 (a) $\beta\frac{r_{ie}}{R_C}$ (b) $\beta\frac{I_C}{R_C}$
 (c) $\beta\frac{V_C}{R_C}$ (d) $\beta\frac{R_C}{r_{ie}}$

84. For a typical arrangement $R_C = 10\ k\Omega$, $r_{ie} = 1\ k\Omega$ and $\beta = 50$, then the voltage gain of the amplifier will be:
 (a) 10 (b) 50
 (c) 500 (d) 5000

85. The SI unit of voltage gain is:
 (a) ampere (b) volt
 (c) coulomb (d) no unit

86. A device which converts low voltage (or current) to high voltage (or current) is called:
 (a) rectifier (b) oscillator
 (c) diode (d) amplifier

87. Transistors with various combinations are widely used as switches in:
 (a) transformers (b) generators
 (c) rectifiers (d) computers

88. A transistor can be used as a switch when:
 (a) the collector and base behave as two terminals
 (b) the collector and emitter behave as two terminals

(c) the base and emitter behave as two terminals
(d) all of these

Operational Amplifier

89. A complete amplifier circuit made on a silicon chip and enclosed in a small capsule is called:
(a) oscillator (b) operational amplifier
(c) rectifier (d) oscillator

90. The integrated amplifier which is used to perform mathematical operations electronically is known as:
(a) rectifier (b) oscillator
(c) op-amp (d) invertor

91. Operational amplifier (op-amp) has the following inputs:
(a) single (b) no
(c) three (d) four

92. An op-amp can be used as a:
(a) inverting and non-inverting amplifier
(b) comparator
(c) night switch
(d) all of these

93. A signal appears after amplification, at the output terminal with a phase shift of 180°, if it is applied at:
(a) inverting input (b) non-inverting input
(c) either of these (d) none of these

94. A signal appears after amplification, at the output terminal without any change of phase, if it is applied at:
(a) inverting input (b) non-inverting input
(c) either of these (d) none of these

95. The resistance between inverting (–) and non-inverting (+) terminals of the op-amp is known as:
(a) input resistance (b) output resistance
(c) internal resistance (d) external resistance

96. The resistance between (+) and (–) inputs of the op-amp is:
(a) very low (b) very high
(c) zero (d) infinity

97. The value of input resistance of op-amp is of the order of:
(a) few ohms (b) milli ohms
(c) kilo ohms (d) mega ohms

98. The resistance between output terminal and ground of the amplifier is known as:
(a) input resistance (b) output resistance
(c) internal resistance (d) external resistance

99. The value of output resistance of op-amp is of the order of:
(a) ohms (b) milli ohms
(c) kilo ohms (d) mega ohms

100. Due to high value of the input resistance, practically, the value of the current which flows between the input terminals is:
(a) zero (b) very small
(c) very large (d) infinity

101. An expression for open loop gain of an op-amp is given as:
(a) $A_{OL} = V_o + V_i$ (b) $A_{OL} = V_o - V_i$
(c) $A_{OL} = \frac{V_o}{V_i}$ (d) $A_{OL} = \frac{V_i}{V_o}$

102. The open loop gain of the op-amp is:
(a) zero (b) infinity
(c) very small (d) very high

103. The open loop gain of op-amp is of the order of:
(a) 10^2 (b) 10^3
(c) 10^4 (d) 10^5

OP - Amplifier as Inverting And Non - Inverting Amplifier, OP – Amplifier as Comparators, Comparator as a Night Switch

104. When op-amp is used as inverting amplifier, which of the input terminal is grounded:
(a) inverting (b) non-inverting
(c) both a and b (d) none of these

105. Gain of an inverting amplifier is given by:
(a) $G = -\frac{R_2}{R_1}$ (b) $G = -\frac{R_1}{R_2}$
(c) $G = 1 + \frac{R_2}{R_1}$ (d) $G = 1 + \frac{R_1}{R_2}$

106. The negative sign in the gain of an inverting amplifier indicates that the output signal is:
(a) in phase with respect to input signal
(b) out of phase (i.e., 180°) with respect to input signal
(c) 90° out of phase with respect to input signal
(d) none of these

107. If $R_1 = 10\ k\Omega$ and $R_2 = 100\ k\Omega$, then the gain of inverting amplifier is:

(a) −90 (b) −110
(c) 10 (d) −10

108. Gain of non-inverting amplifier is given by:
(a) $G = -\frac{R_2}{R_1}$ (b) $G = -\frac{R_1}{R_2}$
(c) $G = 1 + \frac{R_2}{R_1}$ (d) $G = 1 + \frac{R_1}{R_2}$

109. If R_1 = infinity and $R_2 = 0$, then gain of non-inverting amplifier is:
(a) 0 (b) 1
(c) 2 (d) infinity

110. The gain G of op-amp, only depends upon:
(a) internal structure of amplifier
(b) the two externally connected resistances
(c) both a and b
(d) none of these

111. When we are using op-amp as comparator and $V_- > V_+$ then:
(a) $V_o = +V_{CC}$ (b) $V_o = -V_{CC}$
(c) $V_o > -V_{CC}$ (d) $V_o < -V_{CC}$

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113. When comparator is used as a night switch then potential across R_2 provides the reference voltage V_R to the (+) input of the op-amp, which is given by:
(a) $V_R = \frac{R_1}{R_1 + R_2} \times V_{CC}$ (b) $V_R = \frac{R_2}{R_1 + R_2} \times V_{CC}$
(c) $V_R = \frac{R_1 + R_2}{R_1} \times V_{CC}$ (d) $V_R = \frac{R_1 + R_2}{R_2} \times V_{CC}$

114. Automatic functioning of street lights can be done by the use of:
(a) rectifier (b) capacitor
(c) comparator (d) inductor

115. LDR is abbreviated for:
(a) light detection receiver (b) low degree radiations
(c) light dependent resistance (d) low degree rectification

Digital System, Logic Gates, Application Of Gates In Control System

116. A system which deals with quantities or variables which has two discrete values or states is called:
(a) automatic system (b) binary system
(c) number system (d) digital system

117. Digital system can be best carried if it is represented by binary digits:
(a) 0 and 0 (b) 1 and 1
(c) 1 and 0 (d) all of these

118. In describing functions of digital systems, a lighted bulb will be described as:
(a) 0 (b) 1
(c) 2 (d) none of these

119. In describing functions of digital systems, a OFF bulb will be described as:
(a) 0 (b) 1
(c) either of these (d) none of these

120. Special algebra used in digital system is called:
(a) linear algebra (b) Boolean algebra
(c) simple algebra (d) Bernoulli's algebra

121. Boolean algebra is based on which of the following operations:
(a) AND operation (b) OR operation
(c) NOT operation (d) all of these

122. The electronic circuits which implement the various logic operations are known as:
(a) logic gates (b) digital system
(c) electronic gates (d) series circuits

123. The output of two inputs OR gate is 0 only when its:
(a) both inputs are 1 (b) both inputs are 0
(c) either input is 1 (d) either input is 0

124. The output of an OR gate is 1 when:
(a) all the inputs are at 0 (b) all the inputs are at 1
(c) at least one of its input is at 1
(d) none of these

125. Which one of the following are called fundamental gates?
(a) OR gate (b) AND gate
(c) NOT gate (d) all of these

126. The output of AND gate will be zero when:
(a) both inputs are at zero (b) one input is at zero
(c) at least one of its input is zero (d) all of these

127. The output of AND gate will be one when:
(a) both the inputs are at one (b) both the inputs are at zero
(c) any of its input is at one (d) none of these

128. Which one of the following gate is called inverter?
(a) AND (b) OR
(c) NOT (d) none of these

129. The gate which perform the operation of inversion or complementation is called:
(a) OR gate (b) NOT gate
(c) AND gate (d) NOR gate

130. The output of NOR gate is 1 when:
(a) all the inputs are 1 (b) all the inputs are at 0
(c) at least one of its inputs is at 1
(d) none of these

131. NOR gate is used to invert the output of:
(a) AND gate (b) NAND gate
(c) NOT gate (d) none of these

132. The output of NAND gate is 0 when:
(a) all the inputs are at 1
(b) all the inputs are at 0
(c) at least one of the inputs is at 1
(d) none of these

133. NAND gate is used to invert the output of:
(a) OR gate (b) AND gate
(c) NOT gate (d) none of these

134. The output of exclusive OR gate (XOR) is 1, when:
(a) all the inputs are at 1 (b) all the inputs are at 0
(c) inputs are different (d) inputs are identical

135. The output of exclusive NOR gate (XNOR) is 0, when:
(a) all the inputs are at 1 (b) all the inputs are at 0
(c) inputs are identical (d) inputs are different

136. Exclusive OR gate (XOR gate) can be obtained by combining the:
(a) AND gate only (b) OR gate only
(c) NOT gate only (d) all of these

137. Exclusive NOR gate (XNOR gate) can be obtained by combining the:
(a) NOT gate only (b) AND gate only
(c) NOR gate only (d) all of these

138. Exclusive NOR gate (XNOR) can be obtained by inverting the output of:

(a) XOR gate (b) NOT gate
(c) AND gate (d) none of these

139. Truth table of logic function:
(a) summarizes its output values
(b) tabulates all its input conditions only
(c) display all its input/output possibilities
(d) is not based on logic algebra

140. The mathematical notation for OR operation is:
(a) $X = A + B$ (b) $X = \overline{A + B}$
(c) $X = A \, . \, B$ (d) $X = \overline{A \, . \, B}$

141. The mathematical notation for AND operation is:
(a) $X = A + B$ (b) $X = \overline{A + B}$
(c) $X = A \, . \, B$ (d) $X = \overline{A \, . \, B}$

142. The mathematical notation for NOT operation is:
(a) $X = \overline{A \, . \, B}$ (b) $X = A \, . \, B$
(c) $X = \overline{A}$ (d) $X = \overline{A + B}$

143. The mathematical notation for NOR operation is:
(a) $X = \overline{A + B}$ (b) $X = A + B$
(c) $X = A \, . \, B$ (d) $X = \overline{A \, . \, B}$

144. The mathematical notation for NAND operation is:
(a) $X = A + B$ (b) $X = \overline{A + B}$
(c) $X = A \, . \, B$ (d) $X = \overline{A \, . \, B}$

145. The mathematical notation for exclusive OR operation is:
(a) $X = A\overline{B} + \overline{A}B$ (b) $X = \overline{AB + AB}$
(c) $X = \overline{A\overline{B} + \overline{A}B}$ (d) $X = \overline{A + B}$

146. The mathematically notation for exclusive NOR operation is:
(a) $X = AB + \overline{AB}$ (b) $X = \overline{AB + AB}$
(c) $X = \overline{A\overline{B} + \overline{A}B}$ (d) $X = \overline{A + B}$

147. The truth table shown below is for the gate:

A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

(a) OR gate (b) AND gate
(c) NOR gate (d) NAND gate

148. The truth table shown below is for the gate:

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

(a) OR gate (b) AND gate
(c) NOR gate (d) NAND gate

149. It is the truth table for:

A	Output
0	1
1	0

(a) NAND gate (b) OR gate
(c) NOR gate (d) NOT gate

150. The truth table shown below is for the gate:

A	B	Output
0	0	1
0	1	1
1	0	1
1	1	0

(a) NOR gate (b) NAND gate
(c) XOR gate (d) XNOR gate

151. The truth table shown below is for the gate:

A	B	Output
0	0	1
0	1	0
1	0	0
1	1	0

(a) NOR gate (b) NAND gate
(c) XOR gate (d) XNOR gate

152. The truth table shown below is for the gate:

A	B	Output
0	0	1
0	1	0
1	0	0
1	1	1

(a) NOR gate (b) NAND gate
(c) XOR gate (d) XNOR gate

153. The truth table shown below is for the gate:

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0

(a) NOR gate (b) NAND gate
(c) XOR gate (d) XNOR gate

154. The symbol shown below is for the gate:

(a) OR gate (b) AND gate
(c) NOT gate (d) NOR gate

155. The symbol shown below is for the gate:

(a) AND gate (b) NAND gate
(c) NOR gate (d) XOR gate

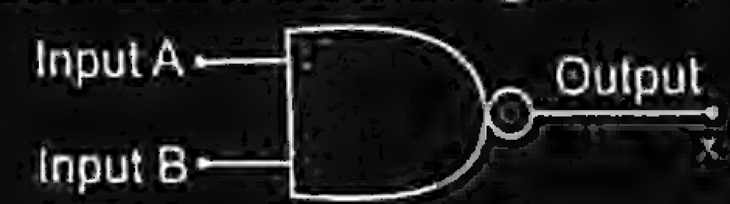
156. The symbol shown below is for the gate:

(a) OR gate (b) AND gate
(c) NAND gate (d) NOT gate

157. The symbol shown below is for the gate:

(a) NAND gate (b) NOR gate
(c) XOR gate (d) XNOR gate

158. The symbol shown below is for the gate:



(a) AND gate (b) NOR gate
(c) XOR gate (d) NAND gate

159. The symbol shown below is for the gate:

(a) NOR gate (b) NAND gate
(c) XOR gate (d) XNOR gate

160. The symbol shown below is for the gate:

(a) OR gate (b) AND gate
(c) NOT gate (d) NOR gate

161. A device which converts some physical quantity into voltage is called:
(a) rectifier (b) amplifier
(c) diode (d) sensor

162. Identify the sensors among the following:
(a) microphone (b) thermistor
(c) LDR (d) all of these

163. The level sensor works on the basis of:
(a) AND gate (b) NAND gate
(c) NOR gate (d) XOR gate

Answer Key's

1.	(c) Electronics	2.	(c) fourth group
3.	(a) 4	4.	(d) holes
5.	(a) free electrons	6.	(a) silicon
7.	(c) semi-conductor	8.	(d) both b and c
9.	(d) depletion region	10.	(d) no charge carrier
11.	(a) 0.3V	12.	(c) 0.7V
13.	(c) absence of charge carriers	14.	(d) potential barrier
15.	(c) stops the mutual movement of both holes and electrons	16.	(a) forward biased
17.	(b) reverse biased	18.	(c) few ohms
19.	(b) milli-amperes	20.	(a) low resistance
21.	(a) resistor	22.	(b) mega ohms
23.	(b) micro-amperes	24.	(b) infinite resistance
25.	(b) majority charge carriers	26.	(d) majority charge carriers
27.	(a) $r_f = \dfrac{\Delta V_f}{\Delta I_f}$	28.	(c) voltage and current
29.	(c)	30.	(a) widened
31.	(a) an amplifier	32.	(b) anode
33.	(a) 2	34.	(b) rectification
35.	(d) diode	36.	(c) half wave rectification
37.	(d) one half of the input cycle	38.	(c) pulsating
39.	(b) D.C.	40.	(b) reverse biased
41.	(d) four	42.	(c) AC source + load + diode + transformer
43.	(b) both halves of the input voltage are used	44.	(c) Filter
45.	(d) all of these	46.	(a) emission of energy in the form of photons
47.	(d) all of these	48.	(d) the type of semiconductor material used

49.	(b) photodiode	50.	(d) all of these
51.	(a) reverse biased	52.	(c) light energy into electrical energy
53.	(b) silicon	54.	(a) intensity of light
55.	(c) 0.6V	56.	(a) satellites
57.	(d) a few milli amperes	58.	(c) nano-seconds
59.	(b) p-n-p transistor	60.	(a) n-p-n transistor
61.	(a) two back to back p-n junctions	62.	(d) doped semi-conductors
63.	(c) base	64.	(a) forward biased
65.	(b) reverse biased	66.	(b) emitter to base
67.	(a) emitter to base	68.	(b) base
69.	(c) 10^{-6} m	70.	(a) emitter
71.	(a) V_{CC} is much higher the V_{BB}	72.	(b) n-p-n transistor
73.	(a) p-n-p transistor	74.	(b) n-p-n transistor
75.	(c) both a and b	76.	(b) $\beta = \frac{I_C}{I_B}$
77.	(b) hundreds	78.	(c) 250
79.	(c) John Bardeen	80.	(d) transistor
81.	(a) $\frac{V_{out}}{V_{in}}$	82.	(c) amplification
83.	(d) $\beta\frac{R_C}{r_{ie}}$	84.	(c) 500
85.	(d) no unit	86.	(d) amplifier
87.	(d) computers	88.	(b) the collector and emitter behave as two terminals
89.	(b) operational amplifier	90.	(c) op-amp
91.	(b) no	92.	(d) all of these
93.	(a) inverting input	94.	(b) non-inverting input
95.	(a) input resistance	96.	(b) very high
97.	(a) few ohms	98.	(b) output resistance
99.	(d) mega ohms	100.	(a) zero
101.	(c) $A_{OL} = \frac{V_o}{V_i}$	102.	(d) very high

103.	(d) 10^5	104.	(b) non-inverting
105.	(a) $G = -\frac{R_2}{R_1}$	106.	(b) out of phase (i.e., 180º) with respect to input signal
107.	(d) −10	108.	(c) $G = 1 + \frac{R_2}{R_1}$
109.	(b) 1	110.	(b) the two externally connected resistances
111.	(b) $V_o = -V_{CC}$	112.	(a) $V_o + V_{CC}$
113.	(b) $V_B = \frac{R_2}{R_1 + R_2} \times V_{CC}$	114.	(c) comparator
115.	(c) light dependent resistance	116.	(d) digital system
117.	(c) 1 and 0	118.	(b) 1
119.	(a) 0	120.	(a) liner algebra
121.	(d) all of these	122.	(a) logic gates
123.	(b) both inputs are 0	124.	(c) at least one of its input is at 1
125.	(d) all of these	126.	(d) all of these
127.	(a) both the inputs are at one	128.	(c) NOT
129.	(b) NOT gate	130.	(b) all the inputs are at 0
131.	(d) none of these	132.	(a) all the inputs are at 1
133.	(b) AND gate	134.	(c) inputs are different
135.	(c) inputs are identical	136.	(d) all of these
137.	(d) all of these	138.	(a) XOR gate
139.	(c) display all its input/output possibilities	140.	(a) $X = A + B$
141.	(c) $X = A . B$	142.	(c) $X = \overline{A}$
143.	(a) $X = \overline{A + B}$	144.	(d) $X = \overline{A . B}$
145.	(a) $X = A\overline{B} + \overline{A}B$	146.	(c) $X = \overline{A\overline{B} + \overline{A}B}$
147.	(b) AND gate	148.	(a) OR gate
149.	(d) NOT gate	150.	(b) NAND gate
151.	(a) NOR ate	152.	(d) XNOR gate

153.	(c) XOR gate	154.	(b) AND gate
155.	(c) NOR gate	156.	(d) NOT gate
157.	(d) XNOR gate	158.	(d) NAND gate
159.	(c) XOR gate	160.	(a) OR gate
161.	(d) sensor	162.	(d) all of these
163.	(a) AND gate		

Brain Teasing MCQ's (with Hints)

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer.

1. In PN junction, the barrier potential offers opposition to only
   (a) majority carriers in both regions
   (b) minority carriers in both regions
   (c) electrons in N-regions (d) Holes in P-region
2. PN junction diode at low voltage works as insulator if connected
   (a) connected to A.C source (b) in forward bias
   (c) in reverse bias (d) None of above
3. The reverse biasing in a PN junction diode
   (a) decreases the potential barrier
   (b) increases the potential barrier
   (c) increase the number of minority charge carriers
   (d) decrease the number of majority charge carriers
4. A diode as rectifier converts
   (a) A.C to D.C (b) D.C into A.C
   (c) varying D.C into constant D.C (d) low voltage into high voltage
5. The P.side of a junction diode is earthed and N-side is given a potential of -2V. The diode will
   (a) break down (b) not conduct
   (c) conduct (d) partially conduct
6. The PN junction diode acts as

   (a) conductor (b) oscillator
   (c) amplifier (d) rectifier
7. Minority carriers present in a p – type semiconductor are due to
   (a) Bias voltage (b) Thermal agitation
   (c) Addition of impurity (d) ionization of impurity
8. In a semiconductor crystal, if current flows due to breakage of crystal bonds, then semiconductor is called
   (a) acceptor (b) donor
   (c) intrinsic semiconductor (d) extrinsic semiconductor
9. Energy band in solids are a consequence of
   (a) Heisenberg's uncertainty principle (b) Bohr's correspondence principle
   (c) Pascal's principle (d) Pauli's exclusion principle
10. The energy gap in silicon is
   (a) 0.7eV (b) 1.1eV
   (c) 5eV (d) None of these
11. Three semiconductors are arranged in the increasing order of their energy gap as follows. The correct arrangement is
   (a) Tellurium, Germanium, Silicon (b) Tellurium, Silicon, Germanium
   (c) Silicon, Germanium, Tellurium (d) Silicon, Tellurium, Germanium
12. In the depelation region of an unbiased PN junction diode there are
   (a) only electron (b) only holes
   (c) only fixed ions (d) All of above
13. On increasing the reverse bias voltage to a large value in a PN junction diode, The current
   (a) becomes zero (b) remains fixed
   (c) decreases slowly (d) increases suddenly
14. A transistor is made of
   (a) super conductor (b) intrinsic semiconductor
   (c) doped semiconductor (d) All of above
15. The base of transistor is made thin and is very lightly doped so that
   (a) most of the charge carrier cross over to the collector
   (b) A very small number of charge carrier may cross over to the collector
   (c) The transistor may be saved from being damaged
   (d) None of above

16. In an NPN transistor circuit, the collector current is 10mA. If 90% of the electrons emitted reach the collector,
   (a) The emitter current will be 9mA   (b) The emitter current will be 11mA
   (c) The base current will be 11mA   (d) The base current will be –1mA

17. In a common-base transistor circuit, the current gain is 0.98. on changing the emitter current by 5mA, the change in collector current is
   (a) 0.196A   (b) 2.45mA
   (c) 4.9mA   (d) 5.1mA

18. In a common-base amplifier the phase difference between input signal voltage and output voltage is
   (a) 0   (b) $\frac{\pi}{4}$
   (c) $\frac{\pi}{2}$ (d) π

19. The part of transistor, which is heavily doped to produce a large number of majority carriers,
   (a) emitter   (b) base
   (c) collector   (d) None of these

20. The least doped region in a transistor is
   (a) emitter   (b) base
   (c) collector   (d) either emitter or collector

21. The dominant mechanisms for motion of charge carriers in forward and reverse biased silicon P.N junction are
   (a) drift in forward bias, diffusion in reverse bias
   (b) diffusion in forward bias, drift in reverse bias
   (c) diffusion in both forward and reverse bias
   (d) drift in both forward and reverse bias

22. The resistance of reverse biased PN junction diode is about
   (a) 1 ohm   (b) 10^2 ohm
   (c) 10^3 ohm   (d) 10^6 ohm

23. Which of the following is the forbidden energy gap in joules for germanium crystal?
   (a) 1.12×10^{-19} (b) 1.76×10^{-19}
   (c) 1.6×10^{-19} (d) zero

24. The electrical circuit which is used to get smooth DC output from a rectifier circuit is called
   (a) amplifier   (b) filter
   (c) oscillator   (d) All of these

25. If the forward voltage in a diode is increased the width of depletion region
   (a) does not change   (b) fluctuates
   (c) increases   (d) decreases

26. The thickness of depletion region in a PN junction diode is of the order of
   (a) 10^{-3}Km   (b) 10^{-3}m
   (c) 10^{-3}mm   (d) 10^{-6}mm

27. Transistor are useful in equipments such as hearing aids and small radio receivers because transistor
   (a) are inexpensive   (b) can stand rough use
   (c) consume very little power   (d) do not distord sound

28. A logic gate gives high output when any one of its inputs is high. Which of the following is the logic gate
   (a) AND   (b) OR
   (c) NOT   (d) None of above

29. What is the voltage gain in a common emitter amplifier, where input resistance is 3Ω and load resistance 24Ω, β = 0.6?
   (a) 2.4   (b) 4.8
   (c) 8.4   (d) 480

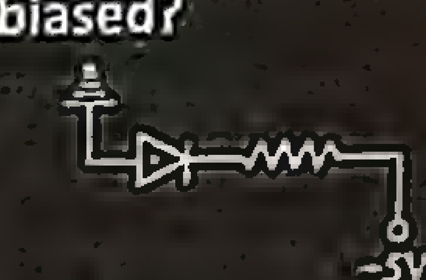
30. The forward biased diode is
   (a) 

   (b) 

   (c) 

   (d) 

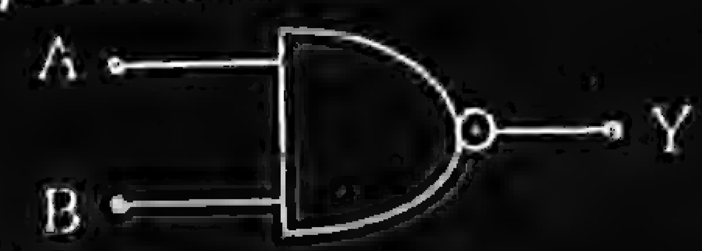
31. Which of the following diodes is reverse biased?
   (a) 

   (b) 

   (c) 

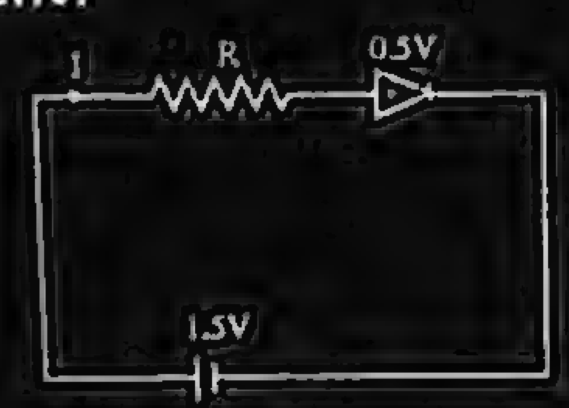
   (d) 

32. The figure shows the symbol of a



(a) AND gate (b) NOR gate
(c) NOT gate (d) NAND gate

33. The diode used in the circuit shown in the figure has constant voltage drop of 0.5V at all currents and a maximum power rating of 100 milliwatts. What should be the value of the resistor R, connected in series with the diode for obtaining maximum current?



(a) 5Ω (b) 5.6Ω
(c) 6.76Ω (d) 20Ω

34. In the middle of the depletion layer of a reverse biased PN junction the
(a) potential is maximum
(b) electric field is maximum
(c) potential is zero (d) electric field is zero

35. If I_c = 4mA and β = 95 then I_E is
(a) 4.1mA (b) 4.02mA
(c) 4.4mA (d) 4.042mA

36. Which amplifier is called current amplifier?
(a) common emitter (b) common base
(c) common collector (d) All of above

37. Which amplifier gives a phase shift of 180° between input and output signal?
(a) common emitter (b) common base
(c) common collector (d) None of these

38. Which amplifier has input impendence low and output impedance high?
(a) common emitter (b) common base
(c) common collector (d) None of these

39. NPN transistor is preferred to PNP transistor because they are
(a) capable of handling large power
(b) electrons have high mobility than holes and hence make fast devices

(c) have no valence band (d) are full of electron gas

40. A logic gate which inverts the input is called
(a) AND gate (b) OR gate
(c) NOT gate (d) None of above

Answer with Hints

No.	Correct Option	Answers	Hint
1	a	majority carrier in both regions	
2	c	in reverse bias	
3	b	increase potential barrier	
4	a	A.C into D.C	
5	c	conduct	
6	d	rectifier	
7	b	thermal agitation	
8	c	intrinsic semiconductor	
9	d	pavli's exclusion principle	
10	b	1.1 eV	
11	a	Tellurium, Germanium Silicon	
12	c	only fixed ions	
13	d	increases suddenly	
14	c	doped semiconductor	
15	a	most of the charge carrier cross over to the collector	
16	b	I_E will be 11mA	
17	c	4.9mA	
18	d	π	
19	a	emitter	

20	b	base	
21	b	Diffusion in forward bias and drift in reverse bias	
22	d	$10^6\Omega$	
23	a	1.12×10^{-19}J	
24	b	filter	
25	d	decreases	
26	c	10^{-3}mm	
27	d	do not distort sound	
28	b	oR gate	
29	b	4.8	$G = \beta \frac{Rc}{rie} = 0.6 \times \frac{24}{3}$
30	d	Diagram	
31	b		
32	d		
33	a	5Ω	
34	b	electric field is maximum	$E = \frac{V}{d}$
35	d	4.042 mA	$I_B = \frac{I_C}{\beta} = \frac{4}{95}$ $= 0.042$mA $I_E = I_C + I_B$ $I_E = 4 + 0.042 = 4.042$ mA
36	c	common collector	
37	a	common emitter	
38	b	common base	
39	b	electron have high mobility than hole and hence make fast devices	
50	c	Not gate	

Additional Short Questions

1. **How will you distinguish between pure semiconductor and semiconductor made from metals?**

Ans. The resistance of semiconductor made of Ge and Si decrease with rise in temperature. But resistance of a semiconductor made from metals increases with rise in temperature.

2. **What is an ideal diode?**

Ans. An ideal diode is one which behaves as a perfect conductor when forward biased and as a perfect insulator when reverse biased.

3. **What are used of LED?**

Ans. LED are used as
(i) indicator lamps, (ii) in signal lamps
(iii) displays in computer and calculator
(iv) The infrared LED is used for optical communication.

4. **What are uses of op-amp?**

Ans. An op-amp can be used as
(i) an inverting and non-inverting amplifer
(ii) It can be used as comparator
(iii) It can be used as automatic night switch.
(iv) It is used to perform different mathematical operations.

5. **Which gates are knows as universal gate?**

Ans. NOR gate, NAND are called universal gate. Because by a suitable combination of NOR and NAND gate we can produce the basic gates OR, AND and NOT gates.

6. **What is job of sensor?**

Ans. A sensor is such a device which converts a particular physical quantity into electrical voltage. For example 'LDR' converts light signal into electrical voltage depending on the intensity of light.

7. **How the p-n junction is formed?**

Ans. If the crystal of germanium or silicon is grown in such a way that its one half is doped with trivalent impurity and the other half is doped with pentavalent impurity then p-n junction is formed.

8. **What is depletion region?**

Ans. The electrons diffuse in p-type material just after the formation of p-n junction. So a chargeless region is formed around the junction, which contains no charge. This region is known as depletion region.

9. What is potential barrier?

Ans. Due to charge on the ions a potential difference develops across the depletion region, which stops the further diffusion of electrons and holes. This potential difference is called potential barrier. The value of potential barrier for Ge is 0.3 volts while for Si is 0.7 volts.

10. Do the semi-conductor devices obey Ohm's law?

Ans. No, the semi-conductor do not obey Ohm's law because their characteristics are high temperature and so their resistance does not remain the same.

11. Why the resistance of the semiconductor decreases with temperature?

Ans. The resistance of semi-conductor decreases with temperature, because covalent bond will unable to withstand even at room temperature, so when the covalent bond is broken, electron-hole pair as a charge carrier will produce, hence the conduction increases.

12. What is an ideal diode?

Ans. Ideal diode is that which offers zero resistance when it is forward biased and infinite resistance when they are reverse biased.

13. Why the silicon diodes are widely used instead of germanium?

Ans. Silicon diodes are widely used instead of germanium because:

(i) Silicon is easily available.

(ii) It is very cheaper as compared to germanium.

(iii) It has more temperature stability as compared to germanium.

(iv) The value of barrier potential for silicon is more (i.e. 0.7 volts) as compared to germanium (i.e. 0.3 volts).

14. What is reverse or leakage current in p–n junction diode?

Ans. In reverse biased p-n junction, the negative terminal of the battery pulls the holes away from the junction and positive terminal attracts electrons. However, a very small current of the order of few micro amperes flows across the junction due to flow of minority charge carrier. This current is known as reverse current or leakage current in p-n junction diode.

15. What is meant by forward biasing and reverse biasing?

Ans. **Forward biasing:** When an external potential is applied across the p-n junction in such a way that positive terminal of the battery is connected with p-type and its negative terminal is connected to n-type material, then p-n junction is said to be forward biased.

Reverse biasing: When an external potential is applied across the p-n junction in such a way that positive terminal of the battery is connected with n-type and its negative terminal is connected to p-type material, the p-n junction is said to be reverse biased. **(Rwp 2006)**

16. Mention some important applications of photo diodes.

Ans. Important applications of photo diodes are

(i) Automatic switching i.e. "ON" or "OFF" of current.

(ii) Logic circuits

(iii) Optical communication equipment

(iv) Detection both visible and invisible radiation. **(Rwp 2004, Lhr 2008)**

17. What is meant by rectification?

Ans. The conversion of alternating current signal into pulsating direct current signal is called rectification. The circuit used for this purpose is called rectifier circuit.

(Lhr 2003, Rwp 2005, Sgd 2005-2006, D.G.Khan 2007, Fsd 2006)

18. Why the full wave rectification is preferred than the half wave rectification?

Ans. We prefer full wave rectification, because it provides, both half cycles of the alternating input signal.

19. Name the circuit which is used to convert the pulsating dc into pure dc in rectification.

Ans. The circuit which is used to convert the pulsating dc into pure dc in rectification is "filter circuit".

Filter circuit is made from the suitable combination of capacitors and inductors.

20. What is meant by transistor? Name its three regions.

Ans. It is an electronic instrument which is formed by the combined effect of p-type and n-type substances, in such a way that the central substance is sandwiched its opposite substances at the other ends. It is used to amplify both current as well as voltage.

Three regions of the transistor are

(i) Emitter

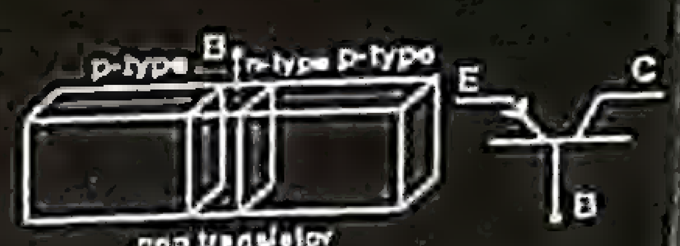
(ii) Base

(iii) Collector **(Mir Pur 2007, Lhr 2008)**

21. Draw the symbols of p-n-p and n-p-n transistors.

Ans. (i) n-p-n transistor

(ii) p–n–p transistor **(Mir Pur 2007)**



22. What is beta amplification factor (current gain)?

Ans. The ratio of collector current Ic to the base current I_B of a certain transistor is always constant. This is called the current gain β of a transistor, which ranges from 30 to 500.

Mathematically,

$$\beta = \frac{I_C}{I_B}$$

23. What is meant by p-n-p and n-p-n transistor?

Ans. P-n-p transistor: When n-type substance (Si or Ge) is sandwiched between two p-type substances then device formed is called p-n-p transistor.

n-p-n transistor: When p-type substance is sandwiched between two n-type substances then device formed is called n-p-n transistor.

24. What is OP-Amp? Why we call it so?

Ans. Amplifier is am important electronic circuit that is used in almost every electronic instrument. Instead of making amplifier by discrete components, the whole amplifier is integrated on a very small silicon chip which is further closed in a capsule.

It can perform mathematically operations such as addition, multiplication and integration, so it is known as operational amplifier.

25. What is open loop gain of OP-Amp?

Ans. It is the ratio of output voltage V_o to voltage difference between non-inverting and inverting inputs, when there is no external connection between the input and output.

Mathematically $A_{OL} = \frac{V_o}{V_+ - V_-} = \frac{V_o}{V_i}$ (Use value is of the order of 10^5)

26. What is difference between inverting and non-inverting amplifiers?

Ans. (i) Inverting amplifier: An amplifier in which signal applied at the inverting input appears after amplification at output terminal with the phase difference of 180°.

(ii) Non-inverting amplifier: An amplifier in which signal applied at the non-inverting input appears after amplification at output without any phase change.

27. Does the gain of an operational amplifier depends upon the internal structure of the OP-Amp?

Ans. No, gain of an operational amplifier depends upon the two externally connected resistances. The gain is independent what is happening inside the amplifier.

28. What is Boolean algebra? What are its basic operations?

Ans. For multiplication of binary numbers (i.e. 0 and 1) we require a special type of algebra known as Boolean algebra. It mathematically performs the different logical operations of any digital electronic system. It is based upon three basic operations namely:

i) AND operation
ii) OR operation
iii) NOT operation

29. Give the Bollean expression for OR, AND and NOT gates

Ans. (i) OR gate: X = A + B

(ii) AND gate: X = A.B

(iii) NOT gate: $X = \overline{A}$

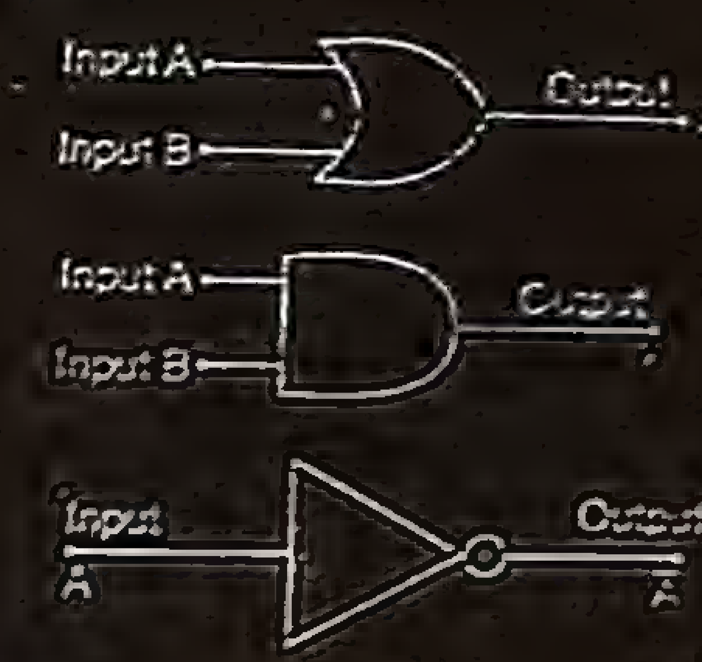
30. Give the symbolical representation of fundamental gates:

Ans.

(i) OR gate

(ii) AND gate

(iii) NOT gate



Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1.  is the electrical symbol for:
(a) Diode (b) Photodiode (c) Photocell (d) LED

2. An expression for current gain of a transistor is given by:
(a) $\beta = \frac{I_B}{I_C}$ (b) $I_E = I_B + I_C$ (c) $I_E = I_C - I_B$ (d) $\beta = \frac{I_C}{I_B}$

3. For non-inverting amplifier if $R_1 = \infty$ ohm and $R_2 = 0$ ohm, then gain of amplifier is:
(a) −1 (b) Zero (c) +1 (d) Infinite

4. If both the inputs are low, the output is high for
(a) OR gate (b) AND gate (c) XOR gate (d) NOR gate

5. The potential barrier in a diode stops the movement of
(a) holes (b) electrons (c) both (a) & (b) (d) none of these

6. Transistors are made from
(a) plastics (b) metals (c) insulators (d) doped semiconductors

7. $X=\overline{A+B}$ is the mathematical notation for
(a) OR gate (b) NOR gate (c) NAND gate (d) AND gate

8. A pentavalent impurity in Si gives
(a) a free electron and a free hole (b) free hole
(c) free electron (d) no free particle

9. The mathematical notation for logic NAND gate is
(a) $X=A+B$ (b) $X=\overline{A+B}$ (c) $X=A.B$ (d) $X=\overline{A.B}$

10. Which one of the following is not semiconductor
(a) copper (b) silicon (c) germanium (d) gallium arsenide

11. A system which deals with quantities or variables which have only two discrete values or states is called
(a) digital systems (b) automatic systems (c) logic gates (d) AC systems

12. Any logic operation can be realized by using only
(a) AND gate (b) NAND gate (c) AND,OR and NOT gate (d) NOT gate

13. A well known example of an intrinsic semiconductor is
(a) germanium (b) phosphorus (c) aluminium (d) cobalt

14. pn-junction can be used as
(a) amplifier (b) oscillator (c) modulator (d) rectifier

15. The SI unit of current gain is
(a) ampere (b) volt (c) ohm-meter (d) no unit

16. The device which keeps working on the input with amplification is called
(a) op-amplifier (b) inverter (c) semiconductor diode (d) none of these

17. LDR is abbreviated for
(a) light dependent resistor (b) light depositing resistor
(c) light doped resistor (d) all of these

Answers Key:

1.	(a) Diode	10.	(a) copper
2.	(d) $\beta=\frac{I_C}{I_B}$	11.	(a) digital systems
3.	(c) +1	12.	(b) NAND gate
4.	(b) AND gate	13.	(a) germanium
5.	(c) both (a) & (b)	14.	(d) rectifier
6.	(d) doped semiconductors	15.	(d) no unit
7.	(b) NOR gate	16.	(a) op-amplifier
8.	(c) free electron	17.	(a) light dependent resistor
9.	(d) $X=\overline{A.B}$		

Chapter 19 DAWN OF MODERN PHYSICS

Topic Wise MCQ's

- Four possible answers to each statement are given below. Tick (✓) the correct answer

Relative Motion, Inertial Frame Of Reference

1. The branch of physics which deals with the behaviour of microscopic particles moving with speed of light is called
   (a) microscopic physics (b) relativistic mechanics
   (c) Newtonian mechanics (d) classical physics
2. The classical physics is based upon the laws of
   (a) quantum mechanics (b) relativistic mechanics
   (c) Newtonian mechanics (d) wave mechanics
3. Modern physics mainly based upon
   (a) quantum physics (b) newton physics
   (c) classical physics (d) nuclear physics
4. Phenomena such as black body radiation, photoelectric effect, the emission of sharp spectral lines by atoms in a gas discharge tube were explained by
   (a) classical physics (b) Astrophysics
   (c) Newtonian physics (d) none of these
5. All motions are
   (a) absolute (b) Relative
   (c) uniform (d) Variable
6. Absolute motion of a body
   (a) in its own frame of reference
   (b) in a different frame of reference
   (c) both (a) and (b)

(d) none of these

7. Any coordinate system relative to which measurement are taken is known as
   (a) M.K.S. system (b) frame of reference
   (c) C.G.S. system (d) none of these
8. A frame of reference which remains at rest or moves with uniform velocity is called
   (a) inertial frame of reference (b) non-inertial frame of reference
   (c) both a & b (d) none of these
9. An inertial frame of reference is that for which
   (a) $a = 0$ (b) $a \neq 0$
   (c) $a > 0$ (d) $a < 0$
10. A frame of reference in which law of inertia is valid is known as
   (a) inertial frame of reference
   (b) non-inertial frame of reference
   (c) accelerated frame of reference
   (d) none of these
11. A non-inertial frame of reference is that which
   (a) is at rest
   (b) moves with uniform velocity
   (c) moves with some acceleration
   (d) has zero acceleration
12. An non-inertial frame of reference is that for which
   (a) $a = 0$ (b) $a \neq 0$
   (c) either of these (d) none of these
13. Newton's laws of motion are not valid in
   (a) inertial frame of reference
   (b) non-inertial frame of reference
   (c) accelerated frame of reference
   (d) both b and c
14. If we are strictly speaking, then earth is
   (a) inertial frame of reference
   (b) non-inertial frame of reference
   (c) either of these
   (d) none of these

Special Theory Of Relativity And Its Results

15. The theory of relativity was proposed by
   (a) Newton (b) Maxwell
   (c) Compton (d) Einstein
16. Special theory of relativity was given in
   (a) 1903 (b) 1905
   (c) 1907 (d) 1911
17. The theory of relativity which deals with non-inertial frame of reference is called
   (a) special theory of relativity (b) general theory of relativity
   (c) newtonion theory (d) classical theory
18. The part of theory of relativity which deals with inertial or non-accelerating frames of reference is known as
   (a) special theory of relativity
   (b) general theory of relativity
   (c) Galilean transformation
   (d) Lorentz's transformation
19. The special theory of relativity is based
   (a) two postulates (b) three postulates
   (c) four postulates (d) none of these
20. According to special theory of relativity, all laws of physics are same in all
   (a) non-inertial frames (b) inertial frames
   (c) accelerated frames (d) none of these
21. The special theory of relativity is applicable to the objects moving with
   (a) nearly equal to speed of light (b) equal to speed of light
   (c) more than speed of light (d) none of these
22. The speed of light in free space is
   (a) constant (b) variable
   (c) 1.6×10^{-19} m/s (d) 3×10^{10} m/s
23. If the speed of light becomes infinite, then the mass of electron moving with velocity 3×10^8 m/s becomes [m_o is the rest mass of electron]
   (a) zero (b) $2m_o$
   (c) m_o (d) infinite
24. According to special theory of relativity, time is
   (a) constant quantity (b) absolute quantity
   (c) not absolute quantity (d) none of these
25. According to special theory of relativity, an expression for time dilation is given by

(a) $t=\dfrac{t_o}{\sqrt{1-\dfrac{c^2}{v^2}}}$ (b) $t=\dfrac{t_o}{\sqrt{1-\dfrac{v^2}{c^2}}}$

(c) $t=t_o\sqrt{1-\dfrac{v^2}{c^2}}$ (d) $t=t_o\sqrt{1-\dfrac{c^2}{v^2}}$

26. In an expression for time dilation, the quantity $\sqrt{1-\frac{v^2}{c^2}}$ is always
(a) equal to zero (b) greater than one
(c) equal to one (d) less than one

27. Due to the relative motion of observer and frame of reference, time
(a) dilates (b) contracts
(c) remains constant (d) none of these

28. According to special theory of relativity, it an object of length l_o with velocity of light, its relativistic length becomes

(a) $\ell=\dfrac{\ell_o}{\sqrt{1-\dfrac{v^2}{c^2}}}$ (b) $\ell=\dfrac{\ell_o}{\sqrt{1-\dfrac{c^2}{v^2}}}$

(c) $\ell=\ell_o\sqrt{1-\dfrac{v^2}{c^2}}$ (d) $\ell=\ell_o\sqrt{1-\dfrac{c^2}{v^2}}$

29. The length contraction happens only
(a) along the direction of motion (b) perpendicular to the direction of motion
(c) in any direction (d) none of these

30. The length of an object or distance between two points measured by an observer who is relatively at rest is called
(a) absolute length (b) normal length
(c) proper length (d) none of these

31. The velocity at which the relativistic length of a body reduces to half of its original length is:

(a) $v=\dfrac{1}{2}c$ (b) $v=\dfrac{3}{2}c$

(c) $v=\dfrac{1}{\sqrt{2}}c$ (d) $v=\dfrac{\sqrt{3}}{2}c$

Hint: Put $\ell=\dfrac{\ell_o}{2}$ in $\ell=\ell_o\sqrt{1-\dfrac{v^2}{c^2}}$

32. If an object moves with a velocity of light, then the apparent length of the object along the direction of motion becomes:

(a) smaller (b) larger
(c) infinity (d) zero

33. According to special theory of relativity, an expression for mass variation is given by

(a) $m=m_o\sqrt{1-\dfrac{v^2}{c^2}}$ (b) $m=m_o\sqrt{1-\dfrac{c^2}{v^2}}$

(c) $m=\dfrac{m_o}{\sqrt{1-\dfrac{v^2}{c^2}}}$ (d) $m=\dfrac{m_o}{\sqrt{1-\dfrac{c^2}{c^2}}}$

34. If a material object moves with speed of light, its mass becomes
(a) zero (b) very small
(c) very large (d) infinity

35. The mass of an object will be doubled at speed:
(a) 2.6×10^8 m/s (b) 1.6×10^8 m/s
(c) 3×10^8 m/s (d) 3.6×10^7 m/s

36. The mass m of a body moving at 0.8 C becomes
(a) $0.67\ m_o$ (b) $1.67\ m_o$
(c) $2.67\ m_o$ (d) $3.67\ m_o$

37. If speed of light were infinity, then moving mass m becomes
(a) ∞ (b) 0
(c) m_o (d) $2m_o$

38. The rest mass of a photon is
(a) zero (b) 3×10^8 m/s
(c) infinity (d) none of these

39. The relativistic mass of a body moving with the velocity of light is
(a) very small (b) very large
(c) infinity (d) zero

40. The Earth's orbital speed is only
(a) 20 km/s (b) 25 km/s
(c) 30 km/s (d) 35 km/s

41. The Einstein-energy mass relation can be expressed as
(a) $E=m/c^2$ (b) $E=mc^2$
(c) $E=m^2c$ (d) $E=mc$

42. A particle with rest mass 'm_o' and relativistic mass 'm' has kinetic energy equal to
(a) $K.E.=(m_o-m)c^2$ (b) $K.E.=(m_o+m)c^2$
(c) $K.E.=(m-m_o)c^2$ (d) $K.E.=(m+m_o)c^2$

43. According to special theory of relativity, mass and energy are different quantities and are:
(a) non-interconvertible (b) inter-convertible
(c) constant (d) none of these

44. According to theory of relativity, the maximum energy that can be obtained from a mass of 10 kg is
(a) 9×10^{14} J (b) 9×10^{15} J
(c) 9×10^{16} J (d) 9×10^{17} J

45. The relativistic change in mass, length and time in daily life are not observed because
(a) the masses of objects are very small
(b) the size of the objects are very large
(c) the speed of the objects are very small as compared to the speed of light
(d) all of these

46. 0.1 kg mass will be equivalent to the energy
(a) 5×10^{8} joules (b) 6×10^{16} joules
(c) 9×10^{16} joules (d) 9×10^{15} joules

47. The speed anywhere on earth can now be determined using relativistic effects by NAVSTAR to an accuracy of
(a) 2 m/s (b) 4 m/s
(c) 6 m/s (d) 8 m/s

48. If you are moving in an aeroplane moving with a speed of 100km/h,then
(a) your pulse rate is slower than that of a person on earth
(b) pulse rate of the person on earth is slower than that of yours
(c) both have the same pulse rate, no difference is noticed.
(d) none of these

Black Body Radiation

49. A black body is that which absorbs
(a) infrared radiation (b) ultraviolet radiation
(c) no radiation (d) all radiations incident on it

50. The nature of radiation emitted by a body depends upon
(a) mass (b) volume
(c) temperature (d) pressure

51. At low temperature, a body generally emits radiations of
(a) smaller wavelength (b) larger wavelength
(c) moderate wavelength (d) all of these

52. At high temperature, a body generally emits radiations of
(a) shorter wavelength (b) larger wavelength

(c) lower frequency (d) all of these

53. At high temperature, the proportion of shorter wavelength radiation
(a) increases (b) decreases
(c) remains the same (d) none of these

54. When the temperature of the body is increased, the radiation becomes richer in
(a) longer wavelength (b) shorter wavelength
(c) either of these (d) none of these

55. When a platinum wire is heated, it appears dull red at about
(a) 500°C (b) 900°C
(c) 1100°C (d) 1300°C

56. When a platinum wire is heated, it appears orange at about
(a) 500°C (b) 900°C
(c) 1100°C (d) 1300°C

57. When a platinum wire is heated, it appears cherry red at about
(a) 500°C (b) 900°C
(c) 1100°C (d) 1300°C

58. When a platinum wire is heated, it appears yellow at about
(a) 500°C (b) 900°C
(c) 1100°C (d) 1300°C

59. When a platinum wire is heated, it appears white at about
(a) 900°C (b) 1100°C
(c) 1300°C (d) 1600°C

60. When a platinum wire is heated, at 1600°C it becomes
(a) orange (b) cherry red
(c) dull red (d) white

61. A good absorber of heat radiations (i.e., black body) would be
(a) a surface coated with lamp black
(b) a hollow cavity within a solid body
(c) a highly polished black body
(d) a tungsten filament

62. An ideal black body is
(a) most efficient radiator
(b) a perfect absorber of radiation
(c) a body whose absorptive power is unity
(d) all of these

63. Absorption power of perfect black body is
(a) zero (b) 1

(c) infinity (d) none of these

64. Black bodies are formed of
(a) reflecting solid objects
(b) non-reflecting solid objects
(c) metals
(d) non-metals

65. If the temperature of a black body is doubled, the total radiation from the body becomes
(a) 4times (b) 16times
(c) 8times (d) 1/16 times

66. Black body energy distribution curves are the graphs between
(a) temperature and intensity (b) wavelength, temperature and intensity
(c) wavelength and intensity (d) wavelength and temperature

67. Who measured the intensity of emitted energy with wavelength radiated from a black body at different temperatures?
(a) Einstein (b) Plank
(c) Lummer and Pringsheim (d) Maxwell

68. In the wien's displacement law i.e., $\lambda_m \times T$ = constant, the value of constant is
(a) 1.9×10^{-3} mK (b) 1.9×10^{3} mK
(c) 2.9×10^{-3} mK (d) 2.9×10^{3} mK

69. Wien's theory explains energy distribution in black body for
(a) larger wavelength (b) shorter wavelength
(c) medium wavelength (d) infinite wavelength

70. According to Stefen-Boltzmann law energy radiated per second per square meter of all the wavelengths at a particular temperature(T) is proportional to
(a) $1/T^2$ (b) $1/T^4$
(c) T^4 (d) T^2

71. The value of Stefen's constant is
(a) $3.67 \times 10^{-8}\ Wm^{-2}K^{-4}$ (b) $5.67 \times 10^{-8}\ Wm^{-2}K^{-4}$
(c) $7.67 \times 10^{-8}\ Wm^{-2}K^{-4}$ (d) $9.67 \times 10^{-8}\ Wm^{-2}K^{-4}$

72. According to Max Plank, energy is released or absorbed in discrete packets called
(a) mesons (b) positrons
(c) quanta (d) none of these

73. Max Plank suggested that energy is released or absorbed in discrete packets in
(a) 1800 (b) 1855
(c) 1900 (d) 1905

74. The discrete nature of radiation was introduced by

(a) Faraday (b) Einstein
(c) Lummer (d) Pringsheim

75. According to Max Planck, the energy of each quanta is
(a) $E = m^2c$ (b) $E = mv^2$
(c) $E = \frac{h}{f}$ (d) $E = hf$

76. The value of Plank's constant h is given by
(a) 6.63×10^{-19} Js (b) 6.63×10^{-34} Js
(c) 1.67×10^{-19} Js (d) 9.1×10^{-31} Js

77. The Plank's constant has the dimensions
(a) $[ML^2T^{-2}]$ (b) $[MLT^{-2}]$
(c) $[ML^2T^{-1}]$ (d) $[ML^{-2}T^2]$

78. The dimensions of Plank's constant h are same as that of
(a) momentum (b) angular momentum
(c) work (d) torque

79. A beam of red light and a beam of blue light have exactly the same energy. Which beam contains the greater number of photons?
(a) blue (b) red
(c) both have same number of photons (d) none of these

80. joule-second (J s) is the unit of
(a) electrical energy (b) angular momentum
(c) plank's constant (d) Both (b) & (c)

81. Energy of a single quanta of electromagnetic radiation is given the name
(a) positron (b) Meson
(c) photon (d) Lepton

82. The name of photon for a quantum of light energy was first introduced by
(a) Max Plank (b) Lummer
(c) Wiens (d) Einstein

83. Assuming you radiate as does a black body at a temperature about 17°C, the wavelength of the emitted radiation is
(a) 1×10^{-6}m (b) 0.1×10^{-5}m
(c) 0.1×10^{-5}m (d) none of these

84. A photon is always considered to be
(a) at rest (b) moving with speed of light
(c) moving with speed of electron (d) moving with speed of sound

85. The momentum of a photon is

(a) $p = \frac{h}{\lambda}$ (b) $p = \frac{\lambda}{h}$

(c) $p = hf$ (d) $p = mc^2$

86. The energy of a photon is given by

(a) $m_o c^2$ (b) $\frac{1}{2}mv^2$

(c) mgh (d) hf

87. An human eye can detect the electromagnetic radiations of the type

(a) infrared radiations (b) far-infrared radiations

(c) x-rays radiations (d) red radiations

88. Radiations are always emitted or absorbed in the form of packets of energy. This is the statement of

(a) Wien's displacement law (b) Stephan-Boltzmann law

(c) Plank's Quantum law (d) Lenz's law

89. A photon is considered to have

(a) energy (b) momentum

(c) wavelength and frequency (d) all of these

90. Which photon, red, green, or blue carries the most energy?

(a) red (b) blue

(c) green (d) all have same energy

91. The energy of a photon of wavelength 1240 nm is

(a) 0.5 eV (b) 1.0 eV

(c) 1.5 eV (d) 2.0 eV

92. The speed of photon as compared with the speed of light is always

(a) same (b) less

(c) greater (d) none of these

93. The momentum of a photon of frequency f is

(a) hf/c (b) hc/f

(c) c/hf (d) f/hc

Photoelectric Effect, Photocell

94. Electromagnetic radiation or photons interact with matter in

(a) two distinct ways (b) three distinct ways

(c) four distinct ways (d) five distinct ways

95. The emission of electrons from a metal surface when exposed to light of suitable frequency is called

(a) Compton effect (b) pair production

(c) photoelectric effect (d) none of these

96. In photoelectric effect, emitted electrons are called

(a) free electrons (b) valence electrons

(c) thermonic electrons (d) photoelectrons

97. The maximum energy of the photoelectrons is given by the equation

(a) $\frac{1}{2}mv_{max}^2 = mgh$ (b) $\frac{1}{2}mv_{max}^2 = \frac{1}{2}kx^2$

(c) $\frac{1}{2}mv_{max}^2 = V_o e$ (d) $\frac{1}{2}mv_{max}^2 = V_o^2 e$

98. The photoelectric effect was explained by

(a) Hertz (b) Einstein

(c) Max Planck (d) Lummer and Pringshein

99. The maximum kinetic energy of emitted photoelectrons depends upon:

(a) the intensity of incident light

(b) frequency of the incident light

(c) particular metal surface

(d) both frequency of incident light and metal surface

100. The number of photoelectrons emitted (or photoelectric current) is directly proportional to the:

(a) frequency of incident light

(b) intensity of incident light

(c) both frequency and intensity of incident light

(d) none of these

101. The maximum energy of the photoelectrons can be determined by making the:

(a) anode positive (b) anode negative

(c) cathode positive (d) both (b) and (c)

102. There is a certain frequency below which no electrons are emitted from the metal surface, this frequency is known as:

(a) critical frequency (b) threshold frequency

(c) maximum frequency (d) minimum frequency

103. The stopping potential (V_o) in photoelectric effect depends on the:

(a) threshold frequency (b) intensity of light

(c) incident frequency of light (d) all of these

104. The stopping potential for a certain metal is 100 volts. Then emitted electron will be max. K.E of emitted electron will be:

(a) 10 J (b) 100 J

(c) 1.6×10^{-17} J (d) 1.6×10^{-19} J

105. The value of threshold frequency (f_o) for different metals is:
(a) different (b) same
(c) zero (d) none of these

106. When the light certain frequency falls on the metal surface, the electrons are ejected:
(a) slowly (b) instantaneously
(c) one by one (d) none of these

107. Energy of each photon is given by the relation:
(a) $E = m_oc^2$ (b) $E = \frac{1}{2}mv^2$
(c) $E = mgh$ (d) $E = hf$

108. The minimum energy needed by an electron to eject from the metal surface is known as:
(a) critical energy (b) threshold energy
(c) work function (d) photoenergy

109. If the threshold frequency of incident light for a metal surface is f_o, its work function (ϕ) will be:
(a) $\phi = hf$ (b) $\phi = hf_o$
(c) $\phi = h(f + f_o)$ (d) $\phi = h(f - f_o)$

110. Einstein's photo-electric equation is given by:
(a) $\frac{1}{2}mv^2_{max} = hf + \phi$ (b) $\frac{1}{2}mv^2_{max} - hf = \phi$
(c) $\frac{1}{2}mv^2_{max} = hf - \phi$ (d) $\frac{1}{2}mv^2_{max} - hf = \phi$

111. Photo electric effect is the converse process of
(a) LASER (b) X-rays
(c) pair production (d) none of these

112. The photoelectric effect can be explained on the basis of:
(a) wave nature of light (b) corpuscular nature of light
(c) dual nature of light (d) all of these

113. In photoelectric effect, if intensity of incident radiation is increased, then there is increase in:
(a) K.E. of electrons (b) number of photons
(c) photoelectric current (d) both (b) and (c)

114. When the K.E_{max} of photoelectron is zero, the frequency of incident photon is ______ that of threshold frequency.
(a) equal to (b) less than

(c) greater than (d) much greater

115. $(K.E.)_{max} = hf - hf_o$ is known as
(a) Compton effect (b) Newton's equation
(c) Planks constant (d) Photoelectric equation

116. The photoelectric effect can be explained by
(a) wave theory of light (b) special theory of relativity
(c) quantum theory of light
(d) electromagnetic theory of light

117. Photoelectric effect was discovered by
(a) Einstein (b) Hertz
(c) Max Planck (d) Wiens

118. In photoelectric effect, light exhibits
(a) wave nature (b) particle nature
(c) either wave nature or particle nature
(d) both wave nature and particle nature

119. Einstein got the Nobel Prize in physics for his explanation of photoelectric effect in:
(a) 1905 (b) 1911
(c) 1921 (d) 1928

120. A device based on photoelectric effect is called
(a) photodiode (b) photocell
(c) voltaic cell (d) photo cathode

121. In a photocell, sodium and potassium emit electrons for
(a) visible light (b) infrared light
(c) ultraviolet light (d) all of these

122. In a photocell, cesium coated oxidized silver emits electrons for
(a) visible light (b) infrared light
(c) ultraviolet light (d) all of these

123. In a photocell, certain metals emit electrons for
(a) visible light (b) infrared light
(c) ultraviolet light (d) all of these

124. Photocells are used for
(a) security and counting systems
(b) automatic door systems
(c) automatic street lighting and sound track of movies
(d) all of these

125. Photocell is a device which converts
(a) electrical energy into chemical energy

(b) heat energy into electrical energy
(c) mechanical energy into electrical energy
(d) light energy into electrical energy

Compton Effect

126. A.H. Compton studied the X-rays by loosely bound electrons from a graphite target in:
(a) 1905 (b) 1911
(c) 1921 (d) 1923

127. In Compton effect, the wavelength of the scattered photon as compared to the wavelength of incident X -rays is:
(a) smaller (b) larger
(c) same (d) none of these

128. In Compton effect, the frequency of the scattered photon as compared to the frequency of incident γ-rays is:
(a) smaller (b) larger
(c) same (d) none of these

129. In Compton effect, it was considered that X -rays consist of:
(a) electrons (b) positrons
(c) neutrons (d) photons

130. The reverse phenomenon of photoelectric effect is called:
(a) pair production (b) Compton effect
(c) Doppler's effect (d) X-rays

131. An expression for Compton shift $\Delta\lambda$ for angle θ is given as:
(a) $\Delta\lambda = \frac{m_o c}{h}(1-\cos\theta)$ (b) $\Delta\lambda = \frac{h}{m_o c^2}(1-\cos\theta)$
(c) $\Delta\lambda = \frac{h}{m_o c}(1-\cos\theta)$ (d) $\Delta\lambda = \frac{m_o c^2}{h}(1-\cos\theta)$

132. In Compton shift, the factor $\frac{h}{m_o c}$ is known as:
(a) Compton wavelength (b) Compton frequency
(c) Compton energy (d) Compton mass

133. The numerical value of Compton wavelength $\frac{h}{m_o c}$ is equal to:
(a) 2.43×10^{-12} m (b) 2.43×10^{-22} m
(c) 2.43×10^{-3} m (d) 2.43×10^{-9} m

134. The angle of scattering for which the Compton shift is maximum is:
(a) 0° (b) 45°
(c) 90° (d) 180°

135. At what angle, the Compton shift '$\Delta\lambda$' equals the Compton wavelength?
(a) 0° (b) 45°
(c) 90° (d) 180°

136. The Compton effect confirms:
(a) wave nature of light (b) particle nature of light
(c) dual nature of light (d) none of these

137. Compton effect makes use of law of conservation of:
(a) energy (b) momentum
(c) both a and b (d) none of these

138. Arthur Holly Compton was awarded Nobel Prize in:
(a) 1905 (b) 1921
(c) 1923 (d) 1927

Pair Production, Annihilation Of Matter

139. The process in which energy is converted into meter is called:
(a) Compton effect (b) pair production
(c) annihilation of matter (d) photoelectric effect

140. The pair of particles produced during the phenomena of pair production are:
(a) electron and neutron (b) electron and proton
(c) electron and photon (d) electron and positron

141. When a very high energy photon interact with a matter, then the following phenomenon taken place:
(a) photoelectric effect (b) β-decay
(c) pair production (d) none of these

142. The minimum energy required by a photon to create a electron-positron pair is:
(a) 1.5 MeV (b) 1.02 MeV
(c) 0.511 MeV (d) 3.0 MeV

143. The process in which energy is converted into matter (i.e., pair production) is also called:
(a) annihilation of matter (b) materialization of energy
(c) both (a) and (b) (d) none of these

144. For an electron or positron, the rest-mass energy is equal to
(a) 1.5 MeV (b) 1.02 MeV
(c) 0.511 MeV (d) 3.0 MeV

145. The process of pair production takes place if the energy of photon is at least
(a) equal to $2m_oc^2$ (b) less than $2m_oc^2$
(c) greater than $2m_oc^2$ (d) none of these

146. Pair production can take place by using
(a) x-rays (b) α-rays
(c) β-rays (d) γ-rays

147. Pair production confirms the
(a) particle nature of light (b) wave nature of light
(c) both particle and wave nature of light
(d) none of these

148. The pair production equation can be written as
(a) $hf = 2m_oc^2 + K.E.\ (e^-)$ (b) $hf = 2m_oc^2 + K.E.\ (e^+)$
(c) $hf = 2m_oc^2 + K.E.\ (e^-) + K.E.\ (e^+)$
(d) $hf = 2m_oc^2$

149. For pair production minimum energy of photon must be
(a) $E = m_0c^2$ (b) $E \geq 2\ m_0c^2$
(c) $E = 2\ m_0c$ (d) none

150. For pair production, there must be conservation of
(a) mass (b) energy
(c) momentum (d) all of these

151. The rest mass energy of an electron is
(a) 9.11×10^{-31} J (b) 6.7 MeV
(c) 0.511 MeV (d) 1.67×10^{-27} J

152. Which of the following radiations has photons of maximum energy?
(a) X-rays (b) γ-rays
(c) microwaves (d) none of these

153. Converse of pair production is called:
(a) photoelectric effect (b) Compton effect
(c) annihilation of matter (d) none of these

154. The pair production and annihilation of matter are:
(a) similar phenomenon (b) opposite to each other
(c) Bases upon classical physics (d) none of these

155. In annihilation of matter, positron and electron pair disappears into two:
(a) α-rays (b) β-rays
(c) γ-rays photons (d) none of these

156. When an electron comes in contact with a positron, they annihilate according to the relation:
(a) $e^- \longrightarrow \gamma + \gamma$ (b) $e^+ \longrightarrow \gamma + \gamma$
(c) $e^- + e^+ \longrightarrow \gamma + \gamma$ (d) $e^- + e^+ \longrightarrow \gamma$

157. The phenomenon which proves Einstein's relation ($E = mc^2$) is:

(a) pair production (b) annihilation of matter
(c) both (a) and (b) (d) photoelectric effect

158. The photons are produced in annihilation of electron and positron, each having energy equal to:
(a) 0.511 MeV (b) 1.02 MeV
(c) 2.04 MeV (d) 3.05 MeV

159. In the process of annihilation of matter, the two photons produced move in opposite direction to conserve:
(a) energy (b) charge
(c) momentum (d) mass

160. The anti matter theory was proposed by:
(a) Einstein (b) Dirac
(c) Carl Anderson (d) Max Planks

161. The existence of positron was predicted by Dirac in
(a) 1922 (b) 1924
(c) 1926 (d) 1928

162. Positron was discovered by Carl Anderson in:
(a) 1930 (b) 1932
(c) 1928 (d) 1935

163. A positron is a antiparticle of:
(a) electron (b) proton
(c) neutron (d) photon

164. A particle and its antiparticle, together at one place:
(a) can exist (b) cannot exist
(c) exist for very short time (d) none of these

165. Which one of the following particles can show diffraction effect?
(a) electron (b) proton
(c) neutron (d) all of these

166. The existence of positron was discovered in the
(a) thermal radiation (b) electromagnetic radiation
(c) cosmic radiation (d) all of these

Wave Nature Of Particles, Electron Microscope

167. The concept that a particle can behave like waves was given by
(a) Compton (b) Einstein
(c) de-Broglie (d) Dirac

168. Louis de-Broglie wavelength of a particle can be expressed by

(a) $\lambda = \frac{p}{h}$ (b) $\lambda = \frac{h}{p}$

(c) $\lambda = \frac{h}{mv}$ (d) both (b) and (c)

169. An object of large mass and ordinary speed has
(a) small wavelength (b) large wavelength
(c) very small frequency (d) none of these

170. In the subatomic world, ________ can be predicted with 100% precision.
(a) few things (b) every thing
(c) nothing (d) none of these

171. According to De-Broglie, an electron can be regarded as
(a) particle only (b) wave only
(c) particle and wave both (d) none of these

172. Interference and diffraction confirms
(a) particle nature of light (b) wave nature of light
(c) dual nature of light (d) none of these

173. It is now believed that light has
(a) particle nature (b) wave nature
(c) dual nature (d) none of these

174. The wavelength of X-rays is of the order of
(a) 10^{-3} m (b) 10^{-15} m
(c) 10^{-13} m (d) 10^{-12} m

175. Wave nature of light appears in
(a) pair production (b) Compton effect
(c) interference and diffraction (d) photoelectric effect

176. De-Broglie's hypothesis was confirmed experimentally by
(a) Lummer and pringsheim (b) Davisson and Germer
(c) Einstein and Max Planks (d) Wiens and Stfean

177. In Davisson and Germer experiment, target crystal was made up of
(a) copper (b) nickel
(c) lead (d) glass

178. Davisson and Germer calculated the wavelength of scattered electron from the relation
(a) $\lambda = \frac{h}{2mVe}$ (b) $\lambda = \frac{h}{2\sqrt{mVe}}$

(c) $\lambda = \frac{2h}{\sqrt{mVe}}$ (d) $\lambda = \frac{h}{\sqrt{2mVe}}$

179. If electron, proton and neutron have same velocity, which of them has the longest wavelength?
(a) proton (b) neutron
(c) electron (d) both proton and neutron

180. In order to perform experiment, Davisson and Germer used accelerating voltage of
(a) 54 V (b) 120 V
(c) 220 V (d) 400 V

181. The beam of electrons diffracted from crystal surface in Davisson and Germer experiment was obtained for a glancing angle of
(a) 60° (b) 65°
(c) 70° (d) 75°

182. Davisson and Germer received the Nobel Prize in
(a) 1921 (b) 1928
(c) 1937 (d) 1940

183. Davisson and Germer got Nobel Prize for their work on
(a) wave nature of particles
(b) the corpuscular nature of particles
(c) dual nature of particles
(d) all of these

184. de Broglie received the Nobel Prize in
(a) 1905 (b) 1937
(c) 1921 (d) 1929

185. de Broglie got Nobel Prize for their work on
(a) wave nature of particles
(b) corpuscular nature of waves
(c) dual nature of particles
(d) all of these

186. Electron and proton have same speed, which one has shorter wavelength associated with them?
(a) electron (b) proton
(c) both have same wavelength (d) none of these

187. Electron microscope makes practical use of the
(a) particle nature of electrons
(b) wave nature of electrons
(c) dual nature of electrons

(d) none of these

188. The screen used in electron microscope is made of________ material.
(a) reflecting (b) absorbing
(c) florescent (d) transparent

189. Which type of electron wavelength is used in electron microscope?
(a) short (b) extremely short
(c) large (d) extremely large

190. With the help of 50 kV electron microscopes, a resolution of ______ is possible.
(a) 0.5 to 1 m (b) 0.5 to 1 cm
(c) 0.5 to 1 nm (d) 0.5 to 1 mm

191. A three dimensional image of remarkable quality can be achieved by modern version called
(a) simple microscope (b) compound microscope
(c) electron microscope (d) scanning electron microscope

192. Which light emits greater number of electron from a metal surface?
(a) bright light (b) Dim light
(c) low frequency light (d) high frequency light

Uncertainty Principle

193. According to ______, electron can never be found in side the nucleus.
(a) Einstein equation (b) Davisson experiment
(c) Heisenberg uncertainty principle (d) Plank's quantum theory

194. Position and momentum of an electron cannot be measured simultaneously with perfect accuracy, this is
(a) Compton effect (b) De-Broglie Principle
(c) Davisson and Germer principle
(d) Uncertainty principle

195. According to Heisenberg's first uncertainty principle, the product of momentum and position of a particle is approximately equal to
(a) Boltzmann's constant (b) Plank's constant
(c) Stephan's constant (d) Universal gas constant

196. In order to observe the position of an electron with more accuracy, one must use light of
(a) larger wavelength (b) shorter wavelength
(c) any wavelength (d) none of these

197. In order to reduce uncertainty in momentum, one must use light of

(a) larger wavelength (b) shorter wavelength
(c) any wavelength (d) none of these

198. According to Heisenberg's second uncertainty principle, the product of energy of a particle and the time at which it has the energy is approximately equal to
(a) Boltzmann's constant (b) Plank's constant
(c) Stephan's constant (d) Universal gas constant

199. The uncertainty in the positron and momentum can be written as
(a) $\Delta x \cdot \Delta p = h$ (b) $\Delta x \cdot \frac{1}{\Delta p} = h$
(c) $\Delta p \cdot \frac{1}{\Delta x} = h$ (d) $\Delta x \cdot \Delta p = \frac{1}{h}$

200. The unit of Plank's constant is
(a) volt (b) Js^{-1}
(c) Js (d) Nm

201. The value of h-bar($\hbar$) is:
(a) 1.05×10^{-34} Js (b) 0.05×10^{-34} Js
(c) 2.05×10^{-34} Js (d) 3.05×10^{-34} Js

202. The form of uncertainty principle which relates the energy of a particle and the time at which it had the energy is given by
(a) $\Delta E \cdot h \approx \Delta t$ (b) $\Delta E \cdot \Delta t \approx 2h$
(c) $\Delta E \cdot \Delta P \approx h$ (d) $\Delta E \cdot \Delta t \approx h$

203. Heisenberg uncertainty principle was proposed in
(a) 1921 (b) 1927
(c) 1937 (d) 1939

204. If measurements show a precise position for an electron, then uncertainty in the measurement of momentum of electron will be
(a) minimum (b) maximum
(c) zero (d) none of these

Answer Key's

1.	(b) relativistic mechanics	2.	(c) Newtonian mechanics
3.	(a) quantum physics	4.	(d) none of these
5.	(b) Relative	6.	(b) in a different frame of reference
7.	(b) frame of reference	8.	(a) inertial frame of reference

9.	(a) a = 0	10.	(a) inertial
11.	(c) moves with some acceleration	12.	(b) $a \neq 0$
13.	(d) both b & c	14.	(b) non-inertial frame of reference
15.	(d) Einstein	16.	(b) 1905
17.	(b) general theory of relativity	18.	(a) special theory of relativity
19.	(a) two postulates	20.	(b) inertial frames
21.	(a) nearly equal to speed of light	22.	(a) constant
23.	(c) m_o	24.	(c) not absolute quantity
25.	(b) $t = \frac{t_o}{\sqrt{1-\frac{v^2}{c^2}}}$	26.	(d) less than one
27.	(c) dilates	28.	(c) $\ell = \ell_o\sqrt{1-\frac{v^2}{c^2}}$
29.	(a) along the direction of motion	30.	(c) proper length
31.	(d) $v = \frac{\sqrt{3}}{2}c$	32.	(d) zero
33.	(c) $m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$	34.	(d) infinity
35.	(a) 2.6×10^8 m/s	36.	(b) $2.67\ m_o$
37.	(c) m_o	38.	(a) zero
39.	(c) infinity	40.	(c) 30 km/s
41.	(b) $E = mc^2$	42.	(c) $K.E. = (m - m_o)c^2$
43.	(b) inter-convertible	44.	(d) 9×10^{17} J
45.	(c) the speed of the objects are very small as compared to the speed of light	46.	(d) 9×10^{23} joules
47.	(a) 2 m/s	48.	(c) both have the same pulse rate, no difference is noticed
49.	(d) all radiations incident on it	50.	(c) temperature
51.	(b) larger wavelength	52.	(a) shorter wavelength

53.	(a) increases	54.	(b) shorter wavelength
55.	(a) 500ºC	56.	(c) 1100ºC
57.	(b) 900ºC	58.	(d) 1300ºC
59.	(d) 1600ºC	60.	(d) white
61.	(b) a hollow cavity within a solid body	62.	(d) all of these
63.	(b) 1	64.	(b) non-reflecting solid objects
65.	(b) 16 times	66.	(c) wavelength and intensity
67.	(c) Lummer and Pringsheim	68.	(c) 2.9×10^{-3} mK
69.	(b) shorter wavelength	70.	(c) T^4
71.	(c) $5.67 \times 10^{-8}\ Wm^{-2}K^{-4}$	72.	(c) quants
73.	(c) 1900	74.	(b) Einstein
75.	(d) E = hf	76.	(b) 6.63×10^{-34} Js
77.	(c) $[ML^2T^{-1}]$	78.	(b) angular momentum
79.	(b) red	80.	(d) both b and c
81.	(c) photon	82.	(d) Einstein
83.	(c) 0.1×10^{-6} m	84.	(b) moving with speed of light
85.	(a) $p = \frac{h}{\lambda}$	86.	(d) hf
87.	(d) red radiations	88.	(c) Plank's Quantum law
89.	(d) all of these	90.	(b) blue
91.	(b) 1.0 eV	92.	(a) same
93.	(a) hf/c	94.	(b) three distinct ways
95.	(c) photoelectric effect	96.	(d) photoelectrons
97.	(c) $\frac{1}{2}mv^2_{max} = V_oe$	98.	(b) Einstein
99.	(d) both frequency of incident light and metal surface	100.	(b) intensity of incident light
101.	(d) both a and c	102.	(b) threshold frequency
103.	(c) incident frequency of light	104.	(c) 1.6×10^{-17} J
105.	(a) different	106.	(b) instantaneously
107.	(d) E = hf	108.	(c) work function

109.	(b) $\theta = hf_o$	110.	(c) $\frac{1}{2}mv^2_{max} = hf - \phi$
111.	(b) X-rays	112.	(b) corpuscular nature of light
113.	(d) both b and c	114.	(a) equal to
115.	(d) photoelectric equation	116.	(c) quantum theory of light
117.	(b) Hertz	118.	(b) particle nature
119.	(c) 1921	120.	(b) photocell
121.	(a) visible light	122.	(b) infrared light
123.	(c) ultraviolet light	124.	(d) all of these
125.	(d) light energy into electrical energy	126.	(d) 1923
127.	(b) larger	128.	(a) smaller
129.	(d) photons	130.	(d) X-rays
131.	(c) $\Delta\lambda = \frac{h}{m_o c}(1 - \cos\theta)$	132.	(a) Compton wavelength
133.	(b) 2.43×10^{-12} m	134.	(d) 180°
135.	(c) 90º	136.	(b) particle nature of light
137.	(c) both a and b	138.	(d) 1927
139.	(b) pair production	140.	(d) electron and positron
141.	(c) pair production	142.	(b) 1.02 MeV
143.	(b) materialization of energy	144.	(c) 0.511 MeV
145.	(c) greater than $2m_oc^2$	146.	(d) γ-rays
147.	(a) particle nature of light	148.	(c) $hf = 2m_oc^2 + K.E.(e^-) + K.E.(e^+)$
149.	(b) $E \geq 2\,m_0c^2$	150.	(d) all of these
151.	(c) 0.511 MeV	152.	(b) γ-rays
153.	(c) annihilation of matter	154.	(b) opposite to each other
155.	(c) γ-rays photons	156.	(c) $e^- + e^+ \longrightarrow \gamma + \gamma$
157.	(c) both a and b	158.	(a) 0.511 MeV
159.	(c) momentum	160.	(b) Dirac
161.	(d) 1928	162.	(b) 1932
163.	(a) electron	164.	(b) cannot exist

165.	(d) all of these	166.	(c) Faraday Science Institution
167.	(c) de-Broglie	168.	(a) $\lambda = \frac{p}{h}$
169.	(a) small wavelength	170.	(a) few things
171.	(c) particle and wave both	172.	(b) wave nature of light
173.	(c) dual nature	174.	(c) 10^{-10} m
175.	(c) interference and diffraction	176.	(b) Davissan and Germer
177.	(b) nickel	178.	(d) $\lambda = \frac{h}{\sqrt{2mVe}}$
179.	(c) electron	180.	(a) 54 V
181.	(c) 65º	182.	(c) 1937
183.	(a) wave nature of particles	184.	(d) 1929
185.	(c) dual nature of particles	186.	(a) electron
187.	(b) wave nature of electrons	188.	(c) florescent
189.	(b) extremely short	190.	(c) 0.5 to 1 nm
191.	(d) scanning electron microscope	192.	(a) bright light
193.	(c) Heisenberg uncertainty principle	194.	(d) uncertainty principle
195.	(b) Plank's constant	196.	(b) shorter wavelength
197.	(a) larger wavelength	198.	(b) Plank's constant
199.	(a) $\Delta x \, . \, \Delta p = h$	200.	(c) Js
201.	(a) 1.05×10^{-34} Js	202.	(d) $\Delta E \, . \, \Delta t \approx h$
203.	(b) 1927	204.	(b) maximum

Brain Teasing MCQ's (with Hints)

Four possible answers to each statement are given below. Tick (✓) the correct answer

1. Rest mass of photon is
 (a) zero (b) infinity
 (c) $\frac{hf}{c}$ (d) $\frac{hc}{\lambda}$

2. A light of wavelength 5000A° is incident on a metal surface whose work function is 2ev. Which of the following will be the maximum K.E of photoelectron?
 (a) 2ev (b) 1.5ev
 (c) 0.48ev (d) 0.2ev

3. If the frequency of incident light in a photoelectric experiment is doubled then
 (a) maximum K.E of photoelectron is halved
 (b) maximum K.E of photoelectron remains same
 (c) maximum K.E of photoelectron is just doubled
 (d) maximum K.E of photoelectron is more than doubled

4. If n_r and n_v are number of photons emitted by a red bulb and a violet bulb respectively of equal power in a given time then
 (a) $n_r > n_v$ (b) $n_r = n_v$
 (c) $n_r < n_v$ (d) None of these

5. Light of wave length λ falls on a metal having work function $\frac{hc}{\lambda_o}$ photoelectric effect will take place only if
 (a) $\lambda > \lambda_o$ (b) $\lambda \geq 2\lambda_o$
 (c) $\lambda \leq \lambda_o$ (d) None of these

6. Light from a source is incident on two photocells of work function 3ev and 1.5ev respectively. The energy of incident light is 4.5ev. Which of the following is the ratio of the velocities of photoelectron ejected from two photocells.
 (a) $\left(\frac{V_1}{V_2}\right)_{max} = \frac{1}{\sqrt{2}}$ (b) $\left(\frac{V_1}{V_2}\right)_{max} = \frac{1}{2}$

 (c) $\left(\frac{V_1}{V_2}\right)_{max} = \frac{1}{3}$ (d) $\left(\frac{V_1}{V_2}\right)_{max} = \frac{1}{\sqrt{3}}$

7. When stopping potential is applied to the anode of the photocell, no current is observed. This means
 (a) The emission of photoelectron stops
 (b) The photoelectron are emitted but are reabsorbed by the photocathode itself
 (c) The photoelectron are dispersed from the sides of apparatus
 (d) All of the above

8. The work function of a metal is Xev when light of energy 2X is made incident on it maximum K.E of emitted photoelectron will be
 (a) zero (b) Xev
 (c) 2Xev (d) $\frac{X}{2}$ev

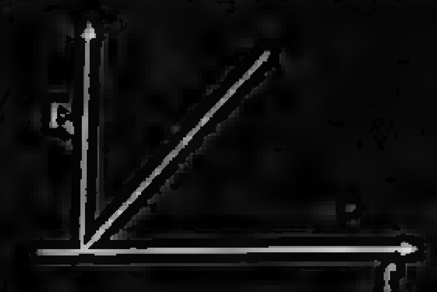
9. If the energy of incident photon is E ev and work function of metal is φ ev then which of the following is the maximum velocity of ejected photoelectron.
 (a) $2m(E-\phi)$ (b) $\frac{2(E-\phi)}{m}$
 (c) $2m\sqrt{E-\phi}$ (d) $\sqrt{\frac{2(E-\phi)}{m}}$

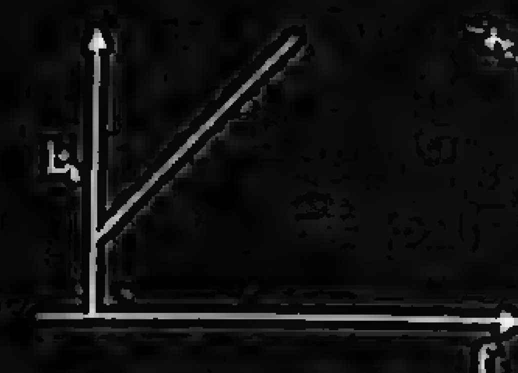
10. The work function of tungsten and sodium are 5.06ev and 2.53ev respectively. If threshold wavelength of sodium is 5896A° then threshold wavelength of tungsten will be
 (a) 11792A° (b) 5896A°
 (c) 2948A° (d) 1474A°

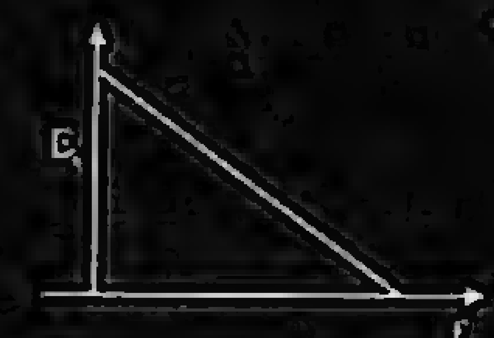
11. The value of threshold wavelength for photoelectric effect is 7000A°. Which of the following radiation will not produce photoelectric effect?
 (a) infrared (b) yellow
 (c) violet (d) ultraviolet

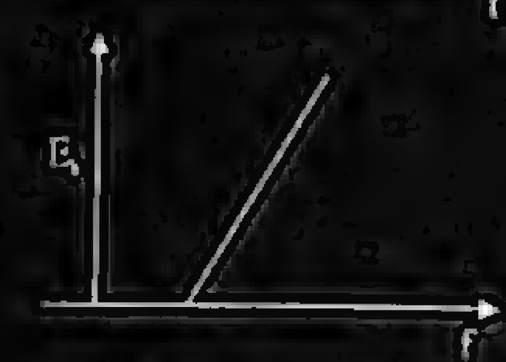
12. The process of photoelectric effect depends on
 (a) wavelength of incident light
 (b) work function of surface
 (c) nature of surface
 (d) All of above

13. The maximum kinetic energy (E_K) of photoelectrons varies with the frequency (f) of the incident radiation as

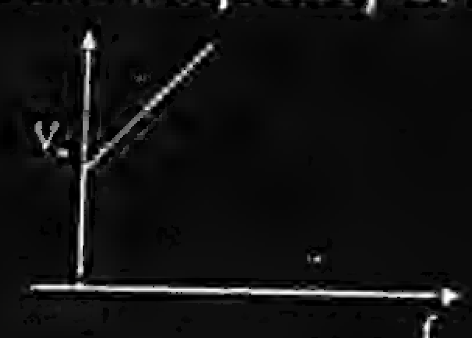
(a) 

(b) 

(c) 

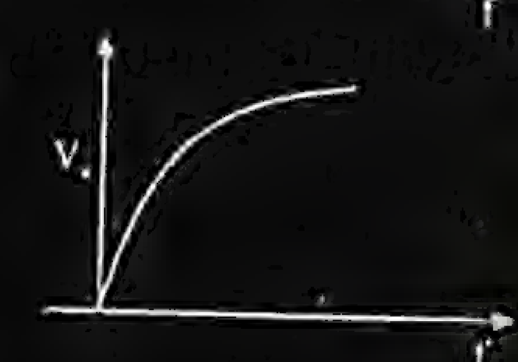
(d) 

14. In photoelectric effect, the graph showing the variation of cut-off voltage (V_o) with the frequency of incident radiation (f) is

(a) 

(b) 

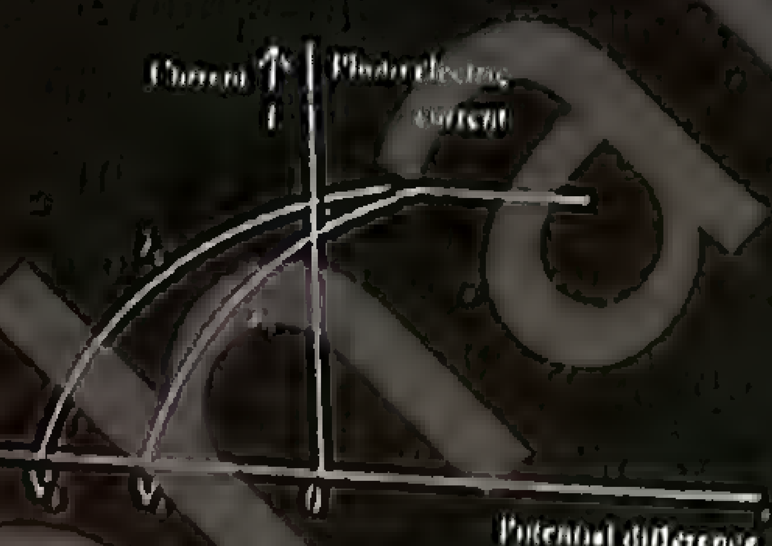
(c) 

(d) 

15. If h is plank's constant, The momentum of a photon of wavelength 0.01A° is
(a) $10^2 h$ (b) $10^6 h$
(c) $10^{12} h$ (d) $10^{-12} h$

16. Moving with same velocity, which of following has large wavelength of the metter waves?
(a) neutron (b) proton
(c) α – particle (d) β – particle

17. In fig if $V_2 > V_1$ then



(a) $\lambda_1 > \lambda_2$ (b) $\lambda_1 < \lambda_2$
(c) $\lambda_1 = \lambda_2$ (d) $\lambda_1 = \sqrt{\lambda_2}$

18. When a photon interact with an electron which of the following characteristics of photon can increase?
(a) wavelength (b) energy
(c) frequency (d) none of these

19. Which of the following achieve conversion of electromagnetic energy in to electrical energy
(a) vacuum tube (b) photocell
(c) cathode ray tube (d) Coolidge tube

20. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. If the frequency is halved and intensity is doubled, the photoelectric current becomes
(a) four times (b) double
(c) half (d) zero

21. Which of the following is the value of plank's constant in (evs)
(a) 6.63×10^{-15}evs (b) 4.14×10^{-15}evs
(c) 4.14×10^{15}evs (d) 1.6×10^{-19}evs

22. When X – rays are scattered by electrons their wavelength increases. This phenomenon is called
(a) Hall effect (b) Thomson effect
(c) Compton effect (d) None of above

23. Compton shift is maximum at an angle
(a) 0° (b) 45°
(c) 90° (d) 180°

24. Which of the following is the value of maximum Compton shift?
(a) $\frac{h}{m_oC}(1-\cos\theta)$ (b) $\frac{h}{m_oC}$
(c) $\frac{2h}{m_oC}$ (d) None of these

25. Which of the following is the Compton shift at an angle 90°?
(a) $\frac{h}{m_oC^2}$ (b) $\frac{h}{m_oC}$
(c) $\frac{m_o}{hC}$ (d) $\frac{m_o}{hC^2}$

26. Dimensions of plank's constant are same as that of
(a) energy density (b) surface energy
(c) gravitational constant (d) angular momentum

27. If E is energy of photon and P is momentum of photon, then velocity of light is equal to

(a) $\frac{E}{P}$ (b) EP

(c) $\frac{P}{E}$ (d) $(EP)^2$

28. de-Broglie waves are associated with

(a) moving charged particles only (b) moving neutral particles only

(c) all moving particles (d) all particles whether in motion or at rest

29. Of the following, the one which has the largest de-Broglie wavelength for the same speed is

(a) electron (b) proton

(c) α – particle (d) oxygen atom

30. An electron and proton are accelerated through the same potential. If their masses are m_e and m_p respectively, then the ratio of their de-broglie wavelength is

(a) 1 (b) $\frac{m_e}{m_p}$

(c) $\frac{m_p}{m_e}$ (d) $\sqrt{\frac{m_p}{m_e}}$

31. An electron, accelerated by a P.D. V has de-Broglie wavelength λ. Which of the following will be the de-Broglie wavelength of electron if electron is accelerated by P.D. 4V?

(a) 4λ (b) 2λ

(c) $\frac{\lambda}{2}$ (d) $\frac{\lambda}{4}$

32. The de-Broglie wavelength of a particle of mass m moving with kinetic energy E is

(a) $\sqrt{\frac{h}{2mE}}$ (b) $\frac{h}{\sqrt{2mE}}$

(c) $\frac{h}{2mE}$ (d) $\frac{\sqrt{h}}{2mE}$

33. A proton, accelerated through a P.D of V has a certain de-Broglie wavelength λ. In order to have the same de-Broglie, an α – particle must be accelerated through a potential difference

(a) 8V (b) 4V

(c) $\frac{V}{4}$ (d) $\frac{V}{8}$

34. Compton effect shows that

(a) photon have momentum (b) X – rays are wave

(c) X – rays can penetrate matter (d) X – rays have high energy

35. A photon of wavelength λ can be associated to have a mass equal to

(a) zero (b) $\frac{h}{c\lambda}$

(c) $\frac{h\lambda}{c}$ (d) $\frac{hc}{\lambda}$

36. Neglecting variation of mass with velocity, The wavelength associated with an electron having kinetic energy E is proportional to

(a) E (b) $E^{\frac{1}{2}}$

(c) $E^{-\frac{1}{2}}$ (d) E^{-2}

37. An electron is placed in a uniform electric field. As the electron moves, its de-Broglie wavelength

(a) decrease (b) increase

(c) remain constant

(d) first increase and then decrease

38. If h is plank's constant and c is speed of photon then which of the following is the wavelength of photon of energy E?

(a) $\frac{C^2}{Eh}$ (b) $\frac{EC^2}{h}$

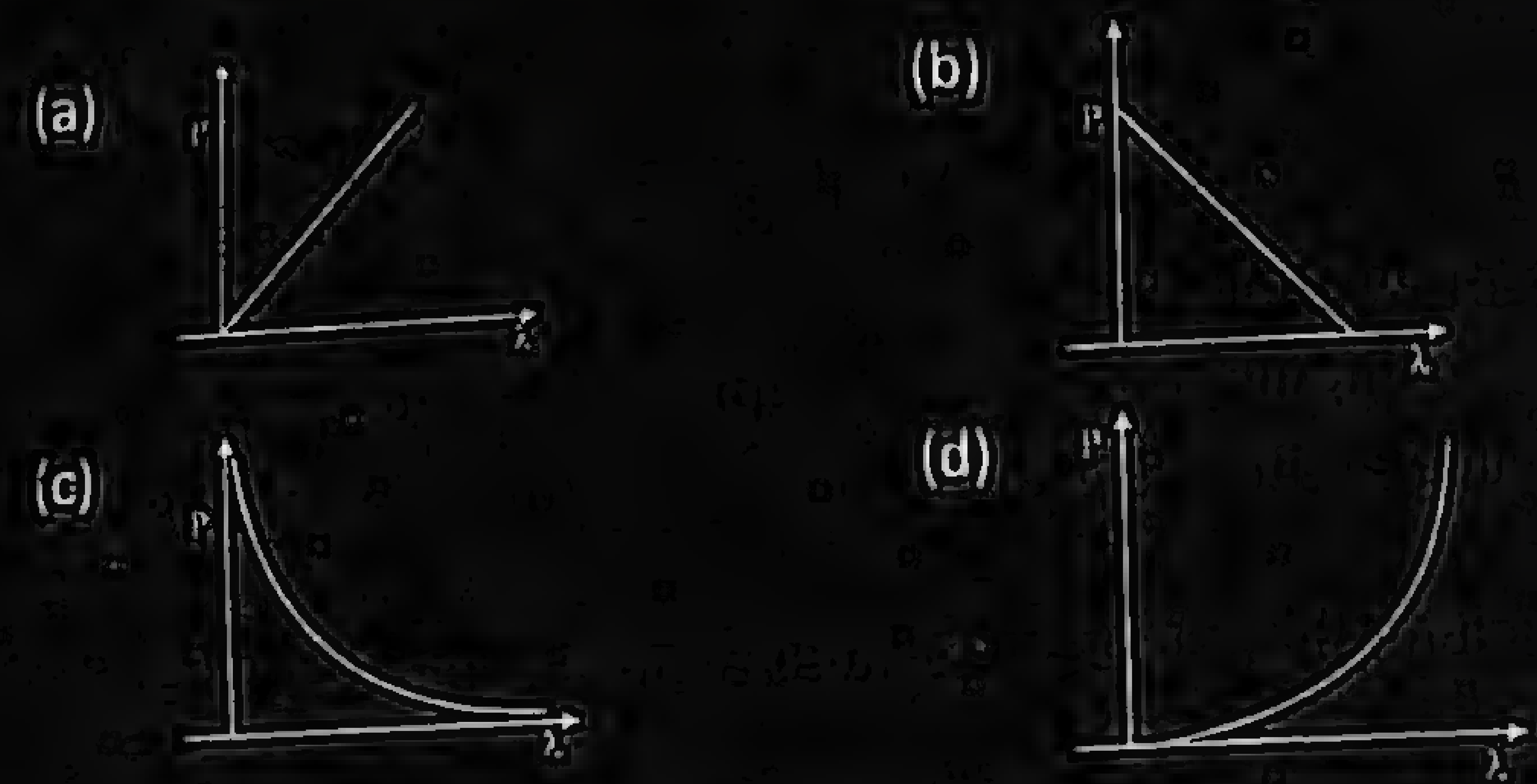
(c) $\frac{E}{hC^2}$ (d) $\frac{hc}{E}$

39. A photon behaves as if it had a mass equal to

(a) $\frac{hf}{C^2}$ (b) $\frac{fC^2}{h}$

(c) $\frac{C^2}{hf}$ (d) hfC^2

40. Which of the following graphs represents the variation of particle momentum and the associated de Broglie wavelength?



Answer with Hints

No.	Correct Option	Answers	Hint
1	a	zero	
2	c	0.48ev	$E = \frac{hc}{\lambda} = 2.48ev$ $K.E = E - \phi$ $= 2.48 - 2$ $= 0.48ev$
3	d	$K.E_{max}$ of photo electron is more than double	If f is made 2f ϕ remain unchanged K.E is more than double
4	a	$n_r > n_v$	
5	c	$\lambda \le \lambda_o$	
6	a	$\left(\frac{V_1}{V_2}\right)_{max} = \frac{1}{\sqrt{2}}$	$\frac{\frac{1}{2}mv_1^2}{\frac{1}{2}mv_2^2} = \frac{4.5-3}{4.5-1.5} = \frac{1.5}{3}$ $\frac{v_1^2}{v_2^2} = \frac{1}{2}$ $= \frac{1}{\sqrt{2}}$

7	b	photo electron are absorbed by photocathode itself	
8	b	XeV	$K.E = E - \phi$ $= 2X - X$ $= X$
9	d	$\sqrt{\frac{2(E-\phi)}{m}}$	$\frac{1}{2}mV_{max}^2 = E - \phi$ $V_{max}^2 = \frac{2(E-\phi)}{m}$ $V_{max} = \sqrt{\frac{2(E-\phi)}{m}}$
10	c	2948A°	work function of tongsien is double than sodium therefore threshold wavelength is half
11	a	infrared	
12	d	All of above	
13	d	Diagram	
14	b		
15	c	$10^{12}h$	$P = \frac{h}{\lambda} = \frac{h}{0.01 \times 10^{-10}}$ $P = 10^{12}h$
16	d	β – particle	
17	a	$\lambda_1 > \lambda_2$	
18	a	wavelength increases	
19	b	photocell	
20	d	zero	
21	b	4.14×10^{-15} evs	$h = 6.63 \times 10^{-34}$ JS

			$h = \frac{6.63\times10^{-34}}{1.9\times10^{-19}}$ evs
22	c	Compton effect	
23	d	180°	
24	c	$\frac{2h}{m_oC}$	$\Delta\lambda = \frac{h}{m_oC}[1-\cos180^\circ]$ $\Delta\lambda = \frac{h}{m_oC}[1-(-1)]$ $\Delta\lambda = \frac{2h}{m_oC}$
25	B	$\frac{h}{m_oC}$	$\Delta\lambda = \frac{h}{m_oC}[1-\cos90^\circ]$
26	d	angular momentum	$[ML^2T^{-1}]$
27	a	$C=\frac{E}{P}$	$\frac{E}{P} = \frac{PC}{P} = C$
28	c	All moving particles	
29	a	electron	$\lambda = \frac{h}{mv}$
30	d	$\sqrt{\frac{m_p}{m_e}}$	$\lambda = \frac{h}{\sqrt{2mVe}}$ $\frac{\lambda_e}{\lambda_p} = \frac{\frac{h}{\sqrt{2m_eVe}}}{\frac{h}{\sqrt{2m_pVe}}}$ $\frac{\lambda_e}{\lambda_p} = \sqrt{\frac{m_p}{m_e}}$
31	c	$\frac{\lambda}{2}$	$\lambda = \frac{h}{\sqrt{2mVe}}$

32	b	$\frac{h}{\sqrt{2mE}}$	$E = \frac{1}{2}mv^2$ $V = \sqrt{\frac{2E}{m}}$ $\lambda = \frac{h}{mv}$ $\lambda = \frac{h}{\sqrt{2mE}}$
33	d	$\frac{V}{8}$	$\lambda = \frac{h}{\sqrt{2mVe}}$ $\lambda^2 = \frac{h^2}{2mVe}$ $V = \frac{h^2}{2me\lambda^2}$
34	a	photon have momentum	
35	b	$\frac{h}{C\lambda}$	$\left(\frac{h}{\lambda}\right)\frac{1}{C} = \frac{P}{C} = \frac{mC}{C} = m$
36	c	$E^{-\frac{1}{2}}$	$\lambda = \frac{h}{\sqrt{2mE}}$
37	a	decrease	$\lambda = \frac{h}{mv}$
38	d	$\frac{hc}{E}$	$\frac{hc}{\frac{hc}{\lambda}} = \frac{hc\lambda}{hc} = \lambda$
39	a	$\frac{hf}{C^2}$	$\frac{hf}{C^2} = \frac{E}{C^2} = m$
40	c	$P = \frac{h}{\lambda}$	

Additional Short Questions

1. **At what speed would mass of a particle become double of its rest mass?**

Ans. $$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$m = 2m_o$$

$$2m_o = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$\sqrt{1-\frac{v^2}{c^2}} = \frac{1}{2}$$

sq. both sides

$$1-\frac{v^2}{c^2} = \frac{1}{4}$$

$$\frac{v^2}{c^2} = 1-\frac{1}{4}$$

$$\frac{v^2}{c^2} = \frac{3}{4}$$

$$\frac{v^2}{c^2} = 0.75$$

$$v^2 = 0.75c^2$$

Taking square root of both sides

$$v = 0.866c$$

2. **Give some characteristic of photon.**

Ans. Following are characteristic of photon.

(i) Photon is a packet of energy.
(ii) The energy of photon is $E = hf$
(iii) Photon travel with speed of light in vacuum.
(iv) The rest mass of photon is zero.
(v) The mass of moving photon is $m = \frac{E}{c^2} = \frac{hf}{c^2}$

(vi) The momentum of photon is $p = \frac{E}{c} = \frac{hf}{c} = \frac{h}{\lambda}$
(vii) Photon do not have any charge. So photons are not deflected is electric and magnetic field.

3. **What is threshold frequency and work function?**

Ans. The minimum frequency of the radiation incident on metal surface required to eject electron from metal surface is called threshold frequency (f_o).
The minimum energy which is just sufficient to eject electrons from the metal surface is called work function. $\varphi = hf_o$

4. **What are uses of photocell?**

Ans. Photocells can be used to operate

(i) Automatic street lighting
(ii) Security system
(iii) Automatic opening of doors.
(iv) Sound track of movies
(v) Automatic counting system
(vi) Fire alarm
(vii) Burglar alarm
(viii) In photometry, it is used for the comparison of the illuminating powers of two sources.

$\lambda'_o < \lambda_o$

5. **Who discovered photoelectric effect?**

Ans. Hertz discovered the photoelectric effect.

6. **Name the phenomenon for which the classical physics is unable to explain?**

Ans. Classical physics is unable to explain the phenomenon such as black body radiation, the photoelectric effect, the emission of sharp spectral lines by atoms in a gas discharge tube.

7. **Name the two most significant features of modern physics.**

Ans. The two most significant features of modern physics are

(i) Special theory of relativity
(ii) Quantum theory

8. **Does the classical mechanics is failed to explain the ordinary processes of everyday life? Discuss.**

Ans. No, classical mechanics is still essential to explain the ordinary processes in our daily life. Newtonion or classical physics deals with objects of large masses moving with small velocities.

9. What is meant by frame of reference?

Ans. A frame of reference is any coordinate system relative to which measurement are taken.

For example, measurements taken in the college laboratory, the laboratory is the reference frame.

10. What are inertial (non-accelerated) and non-inertial (accelerated) frames of reference?

Ans. **Inertial frame of reference:** The frame of reference which is at rest or moving with uniform velocity is called inertial frame of reference. (i.e. $a = 0$)

Non-inertial frame of reference: The frame of reference which is moving with some acceleration is called non-inertial frame of reference. (i.e. $a \neq 0$)

11. Is it possible to describe the absolute rest or motion?

Ans. It is not possible to describe the absolute rest or motion. Motion or rest are the relative quantities.

12. Discuss that earth is an inertial or non-inertial frame of reference.

Ans. Earth is rotating and revolving and hence strictly speaking, the earth is not an inertial frame. But it can often be treated as an inertial frame without serious error because of very small acceleration. (Rwp 2007)

13. What are general and special theory or relativity?

Ans. **General theory of relativity:** The general theory of relativity deals with the problem involving frames of reference accelerated with respect to each other.

Special theory of relativity: The special theory of relativity deals with the problems involving non-accelerated frames of reference.

14. State the postulates of special theory of relativity?

Ans. It has two postulates, which can be stated as follows:

1. The laws of physics are the same in all inertial frames.
2. The speed of light in free space has the same value for all observers, regardless of their state of motion. (Lhr 2005-2006)

15. If we keep on applying force on a material object, can it gain the speed of light?

Ans. No, we cannot accelerate a body with speed of light.

As $m = \dfrac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$ if $v = c$ then

$$m = \frac{m_o}{\sqrt{1-\frac{c^2}{c^2}}} = \frac{m_o}{\sqrt{1-1}} = \frac{m_o}{0} = \infty$$

As infinite mass require an infinite force to accelerate it. But infinite force is not available so an object cannot be accelerated to the speed of light. (Lhr 2005-2006)

16. Discuss that the relativistic effects are not prominent in everyday situation?

Ans. Relativistic effects are not prominent in everyday situation because it is not possible to accelerate any material object at the speed of light.

17. What is NAVSTAR navigation system?

Ans. NAVSTAR navigation system is the practical use of special theory of relativity. With this system, location and speed of the air craft anywhere on the earth can now be determined to an accuracy of about 2 cms^{-1}. If relativity effects are not taken into account, speed calculated would differ by 20 cms^{-1} from the actual value.

18. What are black body radiations?

Ans. **Black body Radiations:** When a black body is heated, it emits radiation of all possible wavelengths. The radiation emitted by such black body are called black body radiation. (Mtn 2005, Rwp 2006, Grw 2006)

19. How can we able to obtain the black body radiator (cavity radiator)?

Ans. We can obtain black body radiator by making a small cavity in a solid body whose inner walls are coated with lamp black or soot thus a small hole in the wall of a solid body is the nearest approach to a black body.

20. Why the rest mass of a photon is zero?

Ans. As relativistic mass is given by $m = \dfrac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$

A photon of rest mass m_o always travel with velocity of light i.e. V=C, so above equation becomes

$$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{m_o}{\sqrt{1-1}} = \frac{m_o}{0} = \infty.$$

If m_o is not zero then moving mass becomes infinite, and its energy will also become infinite. As photon does not possesses infinite energy. So the rest mass of photon must be zero.

21. State Wien's displacement law?

Ans. According to Wien's displacement law,

At a given temperature T, the emitted energy has maximum value for a certain wavelength λ_{max} and the product $\lambda_{max} \times T$ remains constant.

Mathematically, $\lambda_{max} \times T = \text{constant}$

The value of the constant is about 2.9×10^{-3} mk

22. State the Stefen's Boltzman's law?

Ans. According to Stefen's soltzman law, the energy radiated is directly proportional to the fourth power of Kelvin temperature T.

Mathematically, $E \propto T^4$

Or $E = \sigma T^4$

where 'σ' is Stefen's constant and its value is $5.67 \times 10^{-8}\ Wm^2K^{-4}$.

23. What is the Max Plank's view about the nature of radiation?

Ans. According to Max Plank, the radiation from black body are always emitted or absorbed in the form of packets of energies.

The energy associated to radiation is directly proportional to its frequency i.e

$E \propto f$

or $E = hf$ where 'h' is plank's Constant.

(Mtn 2006)

24. Derive the relation between energy and momentum of the electromagnetic radiations?

Ans. As according to Max Plank, $E = hf$

or $E = \frac{hc}{\lambda}$ (as $f = \frac{c}{\lambda}$)

Since $P = \frac{h}{\lambda}$, so equation (b) becomes

$E = pc$ which is the relation between energy and momentum.

25. What are some important factors upon which photo electric effect depends?

Ans. Photo electric effect depends on:

(i) The frequency of incident light.

(ii) Nature of the metallic surface

(iii) Threshold frequency of the metal.

26. What is meant by stopping potential or cut off potential?

Ans. The potential at which the photoelectric current become zero is called the stopping potential 'V_o'

27. How the photo electric emission effected with intensity of incident light?

Ans. Photo electric emission increases with intensity of light. Thus with the increase of intensity of light, the photo-electric current increases.

28. How the photo electric emission effected with frequency of incident light?

Ans. If the intensity of light is kept constant and an experiment is performed with different frequencies of incident light, then there will be no effect on photo-electric emission. Only the K.E. of photons increases with the increase of frequency of light.

29. What is meant by threshold frequency?

Ans. The minimum value of frequency of incident light at which electrons are emitted from a surface is called threshold frequency 'f_o'.

30. What is meant by work function?

Ans. The minimum energy required to escape an electrons from any metallic surface is called its work function. It is denoted by 'ϕ'.

(Lhr 2004)

31. Write the Einstein's photo-electric equation.

Ans. Einstein photo-electrons equation is

$(K.E.)_{max} = hf - \phi$.

32. What is a photo cell?

Ans. A photocell is a device which converts light energy into electrical energy. The working of a photocell is based on photo-electric effect.

33. Calculate the energy corresponds to one kilogram of mass?

Ans. According to Einstein's mass energy relation

$E = mc^2$ where $m = 1$ kg

Putting values, we get

$E = 1 \times (3 \times 10^8)^2$ and $C = 3 \times 10^8\ ms^{-1}$

$E = 9 \times 10^{16}$ J

34. What is Compton's effect?

Ans. The phenomenon in which the wavelength of scattered X-rays is larger than the incident X-rays is known as Compton's effect.

(Rwp 2004, D.G.Khan 2005, Fsd 2004)

35. Calculate the maximum value of Compton's shift.

Ans. As Compton's shift for scattering angle 'θ' is given by

$$\Delta\lambda = \frac{h}{m_o c}(1 - \cos\theta)$$

For maximum value $\theta = 180^\circ$

So $\Delta\lambda = \frac{h}{m_o c}(1 - \cos 180^\circ) = \frac{2h}{m_o c} = 4.86 \times 10^{-12}\text{m}$

which is the maximum value of Compton's shift.

36. **Why pair production is also known as materialization of energy?**

Ans. In pair production, radiation energy is converted into matter, according to the Einstein mass energy relation $E = mc^2$. Hence it is also known as materialization of energy.

37. **What is annihilation of matter?**

Ans. When a positron comes close to the electron, they annihilate and produce two photons in the X-rays range. This is called annihilation of matter.

$$e^- + e^+ \longrightarrow \gamma + \gamma$$

(Grw 2006)

This is the reverse process of pair production.

38. **What aspects of light can be verified by (i) Photo-electric effect (ii) Compton effect (iii) Pair production?**

Ans. These all justify the particle behaviour of light.

39. **Who firstly predict and discover the existence of positron?**

Ans. The existence of positron was first predicted by Dirac in 1928. Positron was discovered by Carl Anderson in 1932 in the cosmic radiation.

40. **What is a positron?**

Ans. An anti-particle of electron is called Positron. Positron has the same anti mass as that of electron but it carriers positive charge.

41. **A particle and its anti-particle cannot exist together at one place. Why?**

Ans. A particle and its anti-particle cannot exist together at one place because when particle and anti-particle meet, they annihilate (destroy) each other, as a result they disappear and their combined energies appear in other forms.

(Federal 2006)

42. **Who firstly give the view about the wave nature of particle?**

Ans. The French physicist Louis de Broglie in 1924 proposed the view about the wave nature of particle.

Who firstly give the experimental verification of de Broglie hypothesis?

experimental verification of de Broglie hypothesis (i.e. wave nature of ...) was verified by Davisson and Germer.

44. **What is Neils Bohr's principle of complementarity?**

Ans. According to Neils Bohr's principle of complementarity, both wave and particle aspects are required for the complete description of both radiation and matter.

45. **What is electron Microscope?**

Ans. A device for forming magnified images of objects by means of electrons. It makes practical use of wave nature of electrons. It uses electric and magnetic fields instead of lens.

46. **State the Heisenberg uncertainty principle?**

Ans. The principle has two forms:

(i) **Position-momentum Uncertainty:** It states that it is impossible to measure the position and momentum of a particle at the same instant with perfect accuracy.

(ii) **Energy – time uncertainty:** It states that the product of the uncertainty in a measured quantity of energy and the interval of time during which it is measured is approximately equal to Plank's constant.

(Federal 2004)

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. The coordinate system for which law of inertia is valid is called:
   - (a) Special frame of reference
   - (b) Inertial frame of reference
   - (c) Non-inertial frame of reference
   - (d) Standard frame of reference
2. Maximum kinetic energy of photoelectrons depends upon ______ of incident light.
   - (a) Frequency
   - (b) Intensity
   - (c) Brightness
   - (d) Power
3. The number of electrons emitted depend upon:
   - (a) Colour of target surface
   - (b) Shape of the surface

(c) Frequency of incident light (d) Intensity of incident light

4. When platinum wire is heated, then it becomes ---- at temperature about 1600°C:
(a) White (b) Yellow (c) Green (d) Dull red

5. Unit of Plank's constant is:
(a) volt (b) J.s (c) $J.s^{-1}$ (d) eV

6. In Compton scattering, the Compton shift $\Delta\lambda$ will be equal to Compton wavelength, if the scattering angle is:
(a) Zero (b) 45° (c) 60° (d) 90°

7. In photoelectric effect, which factor increases by increasing the intensity of incident photons?
(a) kinetic energy of electrons (b) stopping potential
(c) work function (d) number of emitted electrons

8. Radiation emitted by human body at normal temperature (37°C) lies in
(a) x-ray region (b) visible region
(c) infrared region (d) ultraviolet region

9. Which one is the order of decreasing frequency
(a) x-ray, radio waves, infrared rays (b) ultraviolet rays, visible light, radio waves
(c) infrared rays, visible light, x- rays (d) yellow, green, red

10. For pair production, minimum energy of photon must be
(a) 0.5 MeV (b) 1.02 MeV (c) 931 MeV (d) 2.10 MeV

11. A positron is a particle having
(a) mass equal to electron (b) charge equal to electron
(c) equal mass but opposite charge to electron (d) mass equal to proton

12. All motions are
(a) absolute (b) uniform (c) relative (d) variable

13. Photocell are used for
(a) security system (b) counting system
(c) automatic door system (d) all of these

14. Theory of relativity which deals with the non-inertial frame of reference is called
(a) special theory of relativity (b) general theory of relativity
(c) quantum theory (d) classical theory

15. The physical quantity related to photon that does not change in Compton scattering is
(a) energy (b) speed (c) frequency (d) wavelength

16. In black body radiations, at low temperature a body emits radiations of
(a) long wavelength (b) small wavelength

(c) medium wavelength (d) high energy

17. Plank constant has dimensions
(a) $[ML^2T^{-2}]$ (b) $[ML^2T^{-3}]$ (c) $[ML^2T^{-1}]$ (d) $[MLT^{-2}]$

18. The momentum of the moving photon is
(a) zero (b) hf (c) h/λ (d) λ/h

19. Einstein presented special theory of relativity in
(a) 1850 (b) 1920 (c) 1905 (d) 1932

20. A positron is
(a) an electron (b) a proton
(c) anti-particle of electron (d) anti-particle of proton

21. The Davisson and Gerber experiment indicates
(a) interference (b) polarization (c) electron diffraction (d) refraction

22. Who gave the idea of matter wave
(a) de-Broglie (b) Plank (c) Einstein (d) Huygens

Answers Key:

1.	(b) Inertial frame of reference	12.	(c) relative
2.	(a) Frequency	13.	(d) all of these
3.	(d) Intensity of incident light	14.	(b) general theory of relativity
4.	(a) White	15.	(b) speed
5.	(b) J.s	16.	(a) long wavelength
6.	(d) 90°	17.	(c) $[ML^2T^{-1}]$
7.	(d) number of emitted electrons	18.	(c) h/λ
8.	(c) infrared region	19.	(c) 1905
9.	(b) ultraviolet rays, visible light, radio waves	20.	(c) anti-particle of electron
10.	(b) 1.02 MeV	21.	(c) electron diffraction
11.	(c) equal mass but opposite charge to electron	22.	(a) de-Broglie

Chapter 20 ATOMIC SPECTRA

Topic Wise MCQ's

♦ Four possible answers to each statement are given below. Tick (✓) the correct answer:

Atomic Spectra

1. The branch of physics which deals with the investigation of wavelength and intensities of electromagnetic radiation emitted or absorbed by atoms is called:
   (a) electrography (b) spectrography
   (c) spectroscopy (d) tomography
2. The separation of ordinary white light into its components by the use of prism or grating is called:
   (a) diffraction (b) dispersion
   (c) spectroscopy (d) all of these
3. The radiation emitted from hydrogen filled discharge tube shows:
   (a) band spectrum (b) line spectrum
   (c) continuous spectrum (d) absorption spectrum
4. The type of spectra produced by atoms is:
   (a) continuous spectra (b) band spectra
   (c) discrete or line spectra (d) all of these
5. Which of the following is an example of continuous spectra?
   (a) black body radiation spectrum
   (b) molecular spectra
   (c) atomic spectrum
   (d) none of these
6. Which of the following is an example of band spectra?
   (a) black body radiation spectra

Chapter 20

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(b) molecular spectra
(c) atomic spectra
(d) none of these

7. Which of the following is an example of line spectra?
(a) black body radiation spectrum
(b) molecular spectrum
(c) atomic spectrum
(d) none of these

8. The spectral series were identified in the spectrum of hydrogen by:
(a) Einstein (b) Compton
(c) Max Planks (d) J. J. Balmer

9. The first spectral series in the spectrum of hydrogen atom was identified by Balmer in:
(a) 1880 (b) 1885
(c) 1890 (d) 1895

10. J.R. Rydberg obtained a formula to describe the wavelength of the hydrogen atom in:
(a) 1885 (b) 1894
(c) 1896 (d) 1905

11. The value of Rydberg's constant R_H is:
(a) $1.0974 \times 10^{-7}\ m^{-1}$ (b) $1.0974 \times 10^{7}\ m^{-1}$
(c) $1.0974 \times 10^{-7}\ m$ (d) $1.0974 \times 10^{7}\ m$

12. The SI unit of Rydberg constant is:
(a) m^{-2} (b) ms
(c) m^{-1} (d) ms^{-1}

13. The spectrum of visible sun light ranges from:
(a) 430 nm to 650 nm (b) 600 nm to 900 nm
(c) 400 nm to 700 nm (d) 300 nm to 500 nm

14. For a human eye, the sun light forms a:
(a) line spectrum (b) continuous spectrum
(c) band spectrum (d) none of these

15. The line spectrum of hydrogen atom contains the spectral lines in the region:
(a) visible region (b) infrared region
(c) ultraviolet region (d) all of these

16. The simplest spectrum is that of:
(a) oxygen (b) hydrogen
(c) nitrogen (d) chlorine

17. Lyman series contains the wavelength given by the formula:

(a) $\frac{1}{\lambda} = R_H\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ (b) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ (d) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$

18. Paschen series contains the wavelength given by the formula:
(a) $\frac{1}{\lambda} = R_H\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ (b) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ (d) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$

19. Balmer series contains the wavelength given by the formula:
(a) $\frac{1}{\lambda} = R_H\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ (b) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ (d) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$

20. Brackett series contains the wavelength given by the formula:
(a) $\frac{1}{\lambda} = R_H\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ (b) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$
(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$ (d) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$

21. Pfund series contains the wavelength given by the formula:
(a) $\frac{1}{\lambda} = R_H\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ (b) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$
(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$ (d) $\frac{1}{\lambda} = R_H\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$

22. The wavelength of Lyman series for hydrogen spectrum lies in the:
(a) visible region (b) ultraviolet region
(c) infrared region (d) none of these

23. Balmer series contains the wavelength in the:
(a) visible region (b) ultraviolet region
(c) infrared region (d) none of these

24. Paschen series contains the wavelength in the:
(a) visible region (b) ultraviolet region
(c) infrared region (d) none of these

25. Brackett and Pfund series of spectral lines lies in the:

(a) visible region (b) ultraviolet region
(c) infrared region (d) far-infrared region

26. Radiation with wavelength shorter than violet light is called:
(a) visible radiation (b) ultraviolet radiation
(c) infrared radiation (d) microwave radiation

27. Radiation with wavelength greater than red light is called:
(a) visible radiation (b) ultraviolet radiation
(c) infrared radiation (d) microwave radiation

28. When electron in hydrogen atom jumps from higher orbit into first orbit, the set of lines emitted is called:
(a) Lyman series (b) Balmer series
(c) Paschen series (d) Pfund series

29. When electron in hydrogen atom jumps from higher orbit into third orbit, the set of lines emitted is called:
(a) Balmer series (b) Brackett series
(c) Paschen series (d) Pfund series

30. When electron in hydrogen atom jumps from higher orbit into fifth orbit, the set of lines emitted is called:
(a) Lyman series (b) Pfund series
(c) Balmer series (d) Paschen series

31. When electron in hydrogen atom jumps from higher orbit into second orbit, the set of lines emitted is called:
(a) Lyman series (b) Balmer series
(c) Paschen series (d) Pfund series

32. When electron in hydrogen atom jumps from higher orbit into fourth orbit, the set of lines emitted is called:
(a) Lyman series (b) Balmer series
(c) Brackett series (d) Pfund series

33. Balmer empirical formula explains the electromagnetic radiations of any excited atom in terms of their:
(a) frequency (b) mass
(c) wavelength (d) momentum

34. Which of the following is the spectral series of atomic hydrogen?
(a) Balmer series (b) Paschen series
(c) Brackett series (d) Lyman series

35. The scientist who studied the wavelength of all lines of the hydrogen spectrum in visible region was:
(a) Lyman (b) Balmer

(c) Rydberg (d) Brackett

36. The wave length of shortest wave length in Lyman series is equal to:
(a) R_H (b) $\frac{1}{2}R_H$
(c) $\frac{1}{R_H}$ (d) $\frac{3}{2}R_H$

37. In the spectrum of which of the following will you find Balmer series:
(a) oxygen (b) nitrogen
(c) hydrogen (d) all of these

Bohr's Model Of The Hydrogen Atom, Quantized Radii, Quantized Energies

38. The concept that the "electrons continuously radiate energy during their motion" was given by:
(a) Balmer (b) Neil Bohr
(c) Ruther ford (d) J.J. Thomson

39. According to Bohr atomic model, the angular momentum of electron in an orbit is equal to an integral multiple of:
(a) $\frac{2h}{\pi}$ (b) $\frac{h}{2\pi}$
(c) $\frac{2\pi}{h}$ (d) $\frac{mh}{2\pi}$

40. According to Bohr's 2nd postulate, angular momentum of an electron in one of its allowed orbit is given by:
(a) Conserved (b) in not constant
(c) Zero (d) increases continuously

41. According to 3rd postulate of Bohr's theory:
(a) $E_n - E_p = f\lambda$ (b) $E_n - E_p = hc$
(c) $E_n - E_p = hf$ (d) $E_p - E_n = \frac{hf}{c}$

42. $E_n - E_p = hf$, where hf is the energy of:
(a) atom (b) electron
(c) proton (d) photon

43. Bohr's atomic model of hydrogen atom was proposed by Bohr in:
(a) 1905 (b) 1913
(c) 1921 (d) 1927

44. When electron absorbs some energy, it jumps to:

(a) lower energy level (b) higher energy level
(c) ground level (d) infinity

45. If an electron jumps from lower to higher orbit it will:
(a) absorb energy (b) emit energy
(c) either of these (d) none of these

46. The total energy of an electron remains constant:
(a) in allowed orbits
(b) in any orbit
(c) in jumping from higher to lower orbit
(d) in jumping from lower to higher orbit

47. Electrostatic force between the electron and the nucleus of hydrogen atom is given by:
(a) $F_e = k\frac{e}{r_n}$ (b) $F_e = \frac{k^2e^2}{r_n^2}$
(c) $F_e = \frac{ke^2}{r_n^2}$ (d) $F_e = \frac{ke}{r_n^2}$

48. With increasing orbit number (n) the energy difference between adjacent levels in atoms:
(a) Decreases (b) increases
(c) remains constant (d) decreases for low Z atoms increases for high Z atoms

49. The radius of nth orbit of hydrogen atom can be given by:
(a) $r_n = \frac{n^2h^2}{4\pi^2kme^2}$ (b) $r_n = \frac{n^2h^2}{4\pi kme}$
(c) $r_n = \frac{4\pi^2kme^2}{n^2h^2}$ (d) $r_n = \frac{n^2h^2}{4\pi^2k^2e^2}$

50. The radius of 1st Bohr's orbit for hydrogen atom is:
(a) 0.053 m (b) 0.053 mm
(c) 0.053 nm (d) 0.053 μm

51. Radius of first orbit of an atom is r_1 = 0.053 nm. Radius of second orbit r_2 will be:
(a) 0.106 nm (b) 0.212 nm
(c) 0.053 nm (d) 0.53×10^{-10} nm

52. The radius of the third Bohr orbit in hydrogen atom is greater than the radius of the first orbit by a factor of:
(a) 2 (b) 3
(c) 4 (d) 9

53. 1A° is equal to:
(a) 10^{-8} m (b) 10^{-10} m
(c) 10^{-12} m (d) 10^{-14} m

54. The velocity of moving electron in nth orbit is given by the relation:
(a) $v_n = \frac{nh}{2\pi ke^2}$ (b) $v_n = \frac{n^2h^2}{4\pi^2ke^2}$
(c) $v_n = \frac{nh}{2\pi^2ke^2}$ (d) $v_n = \frac{2\pi ke^2}{nh}$

55. The speed of the electron in the first Bohr orbit is:
(a) $2.19 \times 10^{6}\ ms^{-1}$ (b) $2.19 \times 10^{-6}\ ms^{-1}$
(c) $2.19 \times 10^{5}\ ms^{-1}$ (d) $2.19 \times 10^{-5}\ ms^{-1}$

56. The P.E. of an electron revolving at a distance r_n from the nucleus is:
(a) $P.E. = \frac{ke^2}{r_n}$ (b) $P.E. = -\frac{ke^2}{r_n}$
(c) $P.E. = \frac{ke^2}{r_n^2}$ (d) $P.E. = -\frac{ke^2}{r_n^2}$

57. The total energy of the electron in nth orbit of hydrogen atom around the nucleus is given by:
(a) $E_n = \frac{-ke^2}{2r_n}$ (b) $E_n = \frac{-ke^2}{r_n}$
(c) $E_n = \frac{-ke^2}{2r_n^2}$ (d) $E_n = \frac{ke^2}{r_n}$

58. Ionization energy of Hydrogen atom m first excited stated is:
(a) 13.6eV (b) 3.4eV
(c) -13.6eV (d) none of these

59. The numerical value of ground state energy for hydrogen atom is:
(a) $E_1 = -10.6$ eV (b) $E_1 = 13.6$ eV
(c) $E_1 = -5.6$ eV (d) $E_1 = -13.6$ eV

60. The total energy of the electron in the nth orbit of hydrogen atom can also be written as:
(a) $E_n = -\frac{n^2}{13.6}eV$ (b) $E_n = -\frac{n}{13.6}eV$
(c) $E_n = -\frac{13.6}{n^2}eV$ (d) $E_n = -\frac{13.6}{n}eV$

61. The energy of the 4th orbit in hydrogen atom is:

(a) −2.5 eV (b) −3.50 eV
(c) −13.60 eV (d) −0.85 eV

62. Total energy of an electron in an orbit around the nucleus is the sum of:
(a) vibrational energy and kinetic energy
(b) rotational energy and kinetic energy
(c) potential energy and kinetic energy
(d) rotational energy and vibrational energy

63. The energy of an electron revolving in the second orbit is:
(a) −13.6 eV (b) −3.4 eV
(c) −1.54 eV (d) −2.54 eV

64. When an electron jumps from higher energy orbit to lower energy orbit, the difference of energy appears in the form of:
(a) heat (b) sound
(c) photon (d) meson

65. The total energy of an electron in an orbit around the nucleus is:
(a) zero (b) positive
(c) negative (d) infinity

66. When an electron exists in its lowest state, it is called:
(a) normal state (b) ground state
(c) excited state (d) both normal & ground state

67. The potential required to lift an electron from ground state to excited state is called:
(a) ionization potential (b) excitation potential
(c) critical potential (d) absolute potential

68. The potential required to completely remove an electron from the atom is called:
(a) ionization potential (b) excitation potential
(c) critical potential (d) absolute potential

69. The energy required to lift an electron from ground state to higher energy state is called:
(a) ionization energy (b) excitation energy
(c) threshold energy (d) critical energy

70. In the state n = ∞ of hydrogen atom, total energy of electron is:
(a) 5.2 eV (b) 9.8 eV
(c) zero (d) 10.5 eV

71. The energy required to completely remove an electron from the atom is called:
(a) critical energy (b) threshold energy
(c) excitation energy (d) ionization energy

72. The magnitude of ionization for hydrogen is:

(a) 0.053 eV (b) 0.53 eV
(c) 13.6 eV (d) 3.40 eV

73. If the ionization energy of hydrogen atom is 13.6 eV, the ionization potential will be:
(a) 13.6 V (b) 136.0 V
(c) 3.4 V (d) none of these

74. The relation between Rydberg constant (R_H) and ground state energy (E_o) is given by the relation:
(a) $R_H = \dfrac{hc}{E_o}$ (b) $R_H = \dfrac{E_o}{hc}$
(c) $R_H = E_o \times hc$ (d) $R_H = \dfrac{E_o^2}{hc}$

Inner Shell Transitions And Characteristic X-rays

75. The reverse process of photoelectric effect is called:
(a) Compton effect (b) Production of X-rays
(c) pair production (d) annihilation of matter

76. X-rays were discovered in 1895 by:
(a) Balmer (b) Einstein
(c) Roentgen (d) Curie

77. The emission of photons by a metal when electrons are incident is called:
(a) Compton effect (b) photoelectric effect
(c) X-rays production (d) γ-rays production

78. X-rays exhibit the phenomenon of:
(a) interference (b) diffraction
(c) polarization (d) all of these

79. X-rays are similar in nature to:
(a) cathode rays (b) gamma rays
(c) alpha rays (d) beta rays

80. The rest mass of X-rays photon is:
(a) infinite (b) 9.1×10^{-31} kg
(c) 1.67×10^{-27} kg (d) zero

81. The velocity of X-rays is equal to that of:
(a) cathode rays (b) α-rays
(c) γ-rays or light (d) none of these

82. X-rays are:
(a) electromagnetic waves (b) transverse waves
(c) longitudinal waves (d) mechanical waves

83. **X-rays are:**
(a) high energy electrons (b) high energy protons
(c) radiowaves (d) of unknown wave nature

84. **X-ray diffraction reveals that they are:**
(a) particle type (b) wave type
(c) wave particle type (d) all of these

85. **X-rays are affected by:**
(a) electric field only (b) magnetic field only
(c) both (a) and (b) (d) none of these

86. **X-rays are electromagnetic wave having wavelength in the range of:**
(a) 10^{-6} m (b) 10^{-8} m
(c) 10^{-10} m (d) 10^{-12} m

87. **X-rays and gamma rays of the same wavelength and intensity can be differentiated by observing:**
(a) the nature of their sources
(b) their frequencies
(c) both (a) and (b)
(d) none of these

88. **After the emission of X-rays, the atom of the target is:**
(a) doubly ionized (b) singly ionized
(c) in the excited state (d) in the ground state

89. **Which of the following phenomenon can be studied with X-rays:**
(a) Compton effect (b) photoelectric effect
(c) pair production (d) all of these

90. **Which of the following shell is closest to the nucleus:**
(a) K-shell (b) L-shell
(c) M-shell (d) N-shell

91. **The transition of inner shell electrons in heavy atom gives rise to the emission of:**
(a) low energy γ-rays (b) high energy γ-rays
(c) low energy photons or X-rays
(d) high energy photon or X-rays

92. **The transition of electrons between the various shells give rise to:**
(a) characteristic X-rays spectrum
(b) continuous X-rays spectrum
(c) both (a) and (b)
(d) none of these

93. **K_α characteristics X-rays are produced due to the transition of the electrons:**

(a) from N-shell to M-shell (b) from L-shell to K-shell
(c) from K-shell to L-shell (d) from M-shell to L-shell

94. **A X-rays photon produced due to transition of electron from M-shell to K-shell is called:**
(a) K_α (b) K_β
(c) K_γ (d) none of these

95. **The energy of X-rays depends upon:**
(a) accelerating voltage (b) material of target
(c) both (a) and (b) (d) none of these

96. **The continuous X-rays spectrum is due to an effect known as:**
(a) bremsstrahlung (b) breaking radiation
(c) both (a) and (b) (d) none of these

97. **The continuous X-rays spectrum is obtained due to:**
(a) excitation potential (b) ionization potential
(c) deceleration of impact electrons
(d) all of these

98. **X-rays can cause:**
(a) cancer (b) malaria
(c) both (a) and (b) (d) none of these

99. **X-rays can:**
(a) damage the living tissues (b) effect photographic plate
(c) be used in crystallography (d) all of these

100. **Which of the following radiation will burn the human skin?**
(a) infrared (b) microwaves
(c) X-rays (d) all of these

101. **X-rays eject electrons from matter by:**
(a) pair production (b) annihilation of matter
(c) Compton effect (d) photoelectric effect

102. **The usefulness of X-rays is largely due to their:**
(a) mass (b) density
(c) penetrating power (d) all of these

103. **The penetrating power of X-rays depends on their:**
(a) applied voltage (b) frequency
(c) their source (d) all of these

104. **If the number of electrons hitting the target in the x-tube increases, then the intensity of the X-rays:**
(a) increases (b) decreases

(c) remains constant (d) none of these

105. CAT stands for:
(a) computerized axial tomography
(b) computerized automatic treatment
(c) computerized accelerated tomography
(d) none of these

106. In X-rays producing arrangement, target is made of:
(a) silver (b) cadmium
(c) tungsten (d) cadmium or tungsten

107. X-rays cannot produce pair production because:
(a) they have no charge (b) their rest mass is zero
(c) they are electromagnetic waves
(d) their energy is less than 1.02 MeV

108. One widely used system is computerized axial tomography is called:
(a) α - rays (b) γ-rays
(c) x-rays (d) all of these

109. CAT-scans can be used to detect tumors in:
(a) very small size (b) very large size
(c) medium size (d) all of these

Uncertainty Within The Atom, Laser

110. The diameter of the atom is of the order of:
(a) 10^{-8} m (b) 10^{-10} m
(c) 10^{-12} m (d) 10^{-15} m

111. The size of the nucleus of an atom (i.e. diameter of the nucleus) is of the order of:
(a) 10^{-10} m (b) 10^{-12} m
(c) 10^{-14} m (d) 10^{-16} m

112. Atom is nearly:
(a) 10 times larger than the nucleus
(b) 10^2 times larger than the nucleus
(c) 10^3 times larger than the nucleus
(d) 10^5 times larger than the nucleus

113. The radius of hydrogen atom is about:
(a) 5×10^{-10} m (b) 5×10^{-11} m
(c) 5×10^{-12} m (d) 5×10^{-13} m

114. The maximum uncertainty in the measurement of positron of an electron inside the nucleus is of the order of:

(a) 10^{-8} m (b) 10^{-10} m
(c) 10^{-12} m (d) 10^{-14} m

115. According to uncertainty principle, for hydrogen atom of radius 5×10^{-11} m, the speed of electron is:
(a) less than speed of light (b) greater than speed of light
(c) equal to speed of light (d) zero

116. An electron can never be found:
(a) inside the nucleus (b) outside of a nucleus
(c) at the centre of the nucleus (d) all of these

117. The speed of the electron is given by:
(a) 1.46×10^7 ms^{-1} (b) 1.46×10^8 ms^{-1}
(c) 1.46×10^9 ms^{-1} (d) 1.46×10^{10} ms^{-1}

118. Laser is the acronym for:
(a) light amplification by slow energy radiation
(b) light amplification by simple energy radiation
(c) light amplification by stimulated emission of radiation
(d) light amplification by solar energy radiation

119. Laser is a beam of light, which is:
(a) monochromatic (b) coherent
(c) unidirectional (d) all of these

120. Laser are classified into:
(a) solid laser (b) liquid laser
(c) gas laser (d) solid, liquid and gas laser

121. Laser can only be produced if an atom is in its:
(a) ionized state (b) excited state
(c) normal state (d) all of these

122. Laser radiation is produced when excited atoms make transitions from:
(a) excited state to ground state
(b) excited state to meta-stable state
(c) meta-stable state to ground state
(d) excited stated to normal state

123. In laser beam, all the photons:
(a) have different energy (b) have the same energy
(c) have different frequency (d) have same charge

124. Laser emitted by a laser device has:
(a) single colour (b) many colours
(c) no colours (d) none of these

125. Laser can be made by creating:
(a) meta stable state (b) population inversion
(c) assembly (d) all of these

126. Life of meta stable of most atoms is about:
(a) 10^{-3} sec (b) 10^{-4} sec
(c) 10^{-5} sec (d) 10^{-6} sec

127. The life time of most excited state atoms is about:
(a) 10^{-3} sec (b) 10^{-4} sec
(c) 10^{-8} sec (d) 10^{-10} sec

128. Meta stable state is:
(a) below the excited state (b) above the excited state
(c) parallel to excited state (d) one of excited state

129. The life time of meta stable is:
(a) less the life time of excited state
(b) equal to the life time of excited state
(c) greater than the life time of excited state
(d) none of these

130. The incident photon is absorbed by an atom in the ground state E_1, thereby leaving the atom in the excited state E_2, is called:
(a) induced absorption (b) induced emission
(c) spontaneous emission (d) none of these

131. Emission of photon of energy $hf = E_2 - E_1$ in any arbitrary direction, is:
(a) spontaneous absorption (b) induced absorption
(c) induced emission (d) none of these

132. Laser principle are of ________ kinds:
(a) one (b) two
(c) three (d) five

133. The excited states in which the life time of an electron is of the order of 10^{-3} sec are called:
(a) metastable state (b) normal state
(c) ground state (d) none of these

134. The most common type of lasers used in physics laboratories are:
(a) neon laser (b) argon laser
(c) helium-neon laser (d) all of these

135. Helium-neon laser, discharge tube contains neon:
(a) 15% (b) 55%
(c) 75% (d) 85%

136. Helium-neon laser, discharge tube contains helium:
(a) 10% (b) 15%
(c) 25% (d) 85%

137. Helium and neon have nearly identical:
(a) excited state (b) ionized state
(c) metastable state (d) all of these

138. The metastable state of Helium is nearly at:
(a) 20.61 eV (b) 20.66 eV
(c) 18.70 eV (d) 1.96 eV

139. The metastable state of neon is nearly at:
(a) 20.61 eV (b) 20.66 eV
(c) 18.70 eV (d) 1.96 eV

140. Population inversion is sustained in the neon gas relative to an energy level of:
(a) 20.61 eV (b) 20.66 eV
(c) 18.70 eV (d) 1.96 eV

141. In helium-neon laser, laser light generated has the colour:
(a) green (b) red
(c) blue (d) white

142. In helium-neon laser, generated red light laser has the wavelength:
(a) 410 nm (b) 434 nm
(c) 486 nm (d) 632.8 nm

143. In helium-neon laser, red laser light has energy:
(a) 20.61 eV (b) 20.66 eV
(c) 18.70 eV (d) 1.96 eV

144. Laser has use in:
(a) industry (b) surgery
(c) navigation (d) all of these

145. Laser beam can be used to generate three dimensional images of objects in a process called:
(a) tomography (b) holography
(c) electrography (d) xerography

Answer Key's

1.	(c) spectroscopy	2.	(b) dispersion
3.	(b) line spectrum	4.	(d) all of these
5.	(a) black body radiation spectrum	6.	(b) molecular spectra
7.	(c) atomic spectrum	8.	(d) J.J. Balmer
9.	(b) 1885	10.	(c) 1896
11.	(b) $1.0974 \times 10^7\ m^{-1}$	12.	(c) m^{-1}
13.	(c) 400 nm to 700 nm	14.	(a) line spectrum
15.	(d) all of these	16.	(b) hydrogen
17.	(a) $\frac{1}{\lambda} = R_H\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$	18.	(c) $\frac{1}{\lambda} = R_H\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$
19.	(b) $\frac{1}{\lambda} = R_H\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$	20.	(d) $\frac{1}{\lambda} = R_H\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$
21.	(d) $\frac{1}{\lambda} = R_H\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$	22.	(b) ultraviolet regions
23.	(a) visible region	24.	(c) infrared region
25.	(d) far-infrared region	26.	(b) ultraviolet radiation
27.	(c) infrared radiation	28.	(a) Lyman series
29.	(c) Paschen series	30.	(b) Pfund series
31.	(b) Balmer series	32.	(c) Brackett series
33.	(c) wavelength	34.	(d) Lyman series
35.	(b) Balmer	36.	(c) $\frac{1}{R_H}$
37.	(c) Hydrogen	38.	(c) Ruther ford
39.	(b) $\frac{h}{2\pi}$	40.	(d) increases continuously
41.	(c) $E_n - E_p = hf$	42.	(d) photon
43.	(b) 1913	44.	(b) higher energy level
45.	(a) absorb energy	46.	(a) in allowed orbits

47.	(c) $F_c = \frac{ke^2}{r_n^2}$	48.	(c) remains constant
49.	(a) $r_n = \frac{n^2h^2}{4\pi^2 kme^2}$	50.	(c) 0.053 nm
51.	(b) 0.212 nm	52.	(d) 9
53.	(b) 10^{-10} m	54.	(d) $v_n = \frac{2\pi ke^2}{nh}$
55.	(a) $2.19 \times 10^6\ ms^{-1}$	56.	(b) $P.E. = -\frac{ke^2}{r_n}$
57.	(a) $E_n = \frac{-ke^2}{2r_n}$	58.	(b) 3.4eV
59.	(d) $E_1 = -13.6$ eV	60.	(c) $E_n = -\frac{13.6}{n^2}$eV
61.	(d) − 0.85 eV	62.	(c) potential enrgy and vibrational energy
63.	(b) −3.4 eV	64.	(c) photon
65.	(c) negative	66.	(d) both normal and ground state
67.	(b) excitation potential	68.	(a) ionization potential
69.	(b) excitation potential	70.	(c) zero
71.	(d) ionization energy	72.	(c) 13.6 eV
73.	(a) 13.6 V	74.	(b) $R_H = \frac{E_o}{hc}$
75.	(b) production of X-rays	76.	(c) Roentgen
77.	(c) X-rays production	78.	(d) all of these
79.	(b) gamma rays	80.	(d) zero
81.	(c) γ–rays of light	82.	(a) electromagnetic waves
83.	(b) high energy protons	84.	(b) wave type
85.	(d) none of these	86.	(c) 10^{-10} m
87.	(a) the nature of their sources	88.	(d) in the ground sate
89.	(d) all of these	90.	(a) K-shell

91.	(d) high energy photon or X-rays	92.	(a) characteristic X-rays spectrum
93.	(b) from L-shell to K-shell	94.	(b) K_β
95.	(c) both a and b	96.	(c) both a and b
97.	(c) deceleration of impact electrons	98.	(a) cancer
99.	(d) all of these	100.	(c) X-rays
101.	(d) photoelectric effect	102.	(c) penetrating power
103.	(b) frequency	104.	(a) increases
105.	(c) computerized accelerated tomography	106.	(d) cadmium or tungsten
107.	(d) their energy is less than 1.02 MeV	108.	(c) X-rays
109.	(a) very small size	110.	(b) 10^{-10} m
111.	(c) 10^{-14} m	112.	(d) 10^5 times larer than the nucleus
113.	(b) 5×10^{-11} m	114.	(d) 10^{-14} m
115.	(a) less than speed of light	116.	(a) inside the nucleus
117.	(a) 1.46×10^7 ms^{-1}	118.	(c) light amplification by stimulated emission of radiation
119.	(d) all of these	120.	(d) solid, liquid and gas laser
121.	(b) excited state	122.	(c) meta-stable state to ground state
123.	(b) have the same energy	124.	(a) single colour
125.	(d) all of these	126.	(a) 10^{-3} sec
127.	(c) 10^{-8} sec	128.	(d) one of excited state
129.	(c) greater than the life time of excited state	130.	(a) induced absorption
131.	(d) none of these	132.	(b) two
133.	(a) metastable state	134.	(c) helium-neon laser
135.	(a) 15%	136.	(d) 85%
137.	(c) metastable state	138.	(a) 20.61 eV
139.	(b) 20.66 eV	140.	(c) 218.70 eV
141.	(b) red	142.	(d) 632.8 nm
143.	(d) 1.96 eV	144.	(d) all of these
145.	(b) holography		

Brain Teasing MCQ's (with Hints)

Four possible answers to each statement are given below. Tick (✓) the correct answer:

1. **Gases begin to conduct electricity at low pressures because**
   (a) At low pressure gases turn into plasma
   (b) Colliding electron can acquire higher K.E due to increased mean free path leading to ionization of atoms
   (c) atoms break up into electrons and protons at low pressure
   (d) The electrons in atoms can move freely at law pressure

2. **In discharge tube, electricity is conducted by**
   (a) electrons only (b) protons only
   (c) positive ions and negative ions only (d) electron, positive ions

3. **When electron jumps from the forth orbit to the second orbit, one gets the**
   (a) second line of Lyman series (b) second line of Balmer series
   (c) first line of paschan series (d) first line of pfund series

4. **The ratio of minimum to maximum wavelength in Balmer series is**
   (a) $\frac{1}{4}$ (b) $\frac{3}{4}$
   (c) $\frac{5}{9}$ (d) $\frac{5}{36}$

5. **For which of the following transition infrared radiation will be obtained**
   (a) $2 \longrightarrow 1$ (b) $3 \longrightarrow 2$
   (c) $4 \longrightarrow 2$ (d) $5 \longrightarrow 4$

6. **Which of the following is the K.E of an electron that is accelerated through a potential of 100V?**
   (a) 1.6×10^{-19}J (b) 1.6×10^{-17}J
   (c) 1.6×10^{-15}J (d) 1.6×10^{-13}J

7. **When an electron in an atom goes from a lower to a higher orbit its**
   (a) K.E increase, P.E increase (b) K.E increase, P.E decrease
   (c) K.E decreases, P.E increase (d) K.E decrease, P.E decrease

8. If electron in hydrogen atom jumps from third orbit to second orbit, the emitted radiation has wavelength. (R is Rydberg's constant)

(a) $\frac{36}{5R}$ (b) $\frac{5R}{36}$

(c) $\frac{6}{5R}$ (d) $\frac{5R}{6}$

9. Which of the following is the energy required to remove an electron from the second orbit of hydrogen atom? (ionization potential of H. atom = 13.6V)

(a) 54.4eV (b) 27.2eV

(c) 6.8eV (d) 3.4eV

10. With increasing quantum number the energy difference between adjacent levels in atoms

(a) decreases (b) increases

(c) remain constant (d) none of above

11. The maximum number of electrons in the nth Bohr orbit can be

(a) n (b) 2n

(c) n^2 (d) $2n^2$

12. When electron in hydrogen atom jumps from the second orbit to the first orbit, the wavelength of the radiation emitted is λ. Which of the following will be the wavelength of emitted radiation when electron jump from third to first orbit?

(a) $\frac{9}{4}\lambda$ (b) $\frac{4}{9}\lambda$

(c) $\frac{27}{32}\lambda$ (d) $\frac{32}{27}\lambda$

13. Which of the following is the ratio of K.E to the P.E of the electron is any Bohr orbit of hydrogen atom?

(a) 2 (b) $\frac{1}{2}$

(c) $-\frac{1}{2}$ (d) −2

14. In hydrogen atom electron jumps from first to second orbit, its radius

(a) remain same (b) become half

(c) become double (d) becomes four times

15. If V_1 is the speed of electron in first orbit of hydrogen atom then velocity of electron in 4^{th} orbit will be

(a) $\frac{V_1}{4}$ (b) $\frac{V_1}{2}$

(c) $2V_1$ (d) $4V_1$

16. Which of the following is the frequency of the series limit of Balmer series of hydrogen atom in terms of Rydberg constant R and velocity of light C?

(a) $\frac{RC}{4}$ (b) $\frac{4}{RC}$

(c) RC (d) 4RC

17. Which of the following is the relation between energy (E) and momentum (P) of a photon?

(a) $E^2 = PC^2$ (b) $E^2 = P^2C$

(c) $E^2 = P^2C^2$ (d) $E^2 = \frac{P^2}{C^2}$

18. Hydrogen atom does not emit X – rays because

(a) its energy levels are too close to each other

(b) its energy levels are too far apart

(c) it has very small mass (d) It has a single electron

19. The shortest wavelength of X – rays emitted from X – rays tube depends on the

(a) current in the tube (b) voltage applied to the tube

(c) nature of gas in tube (d) atomic number of target material

20. In an X – ray tube, the intensity of emitted X – rays beam is increased by

(a) decreasing the target potential (b) increasing the target potential

(c) decreasing the filament current (d) increasing the filament current

21. If V is accelerating voltage then which of the following will be the maximum frequency of emitted X – rays from X – rays tube?

(a) $\frac{eh}{v}$ (b) $\frac{hv}{e}$

(c) $\frac{ev}{h}$ (d) $\frac{h}{ev}$

22. A potential difference of 42000 V is used in an x – rays tube to accelerate electrons. Which of the following is the maximum frequency of the emitted x – rays?

(a) 10^{19}HZ (b) 10^{18}HZ

(c) 10^{16}HZ (d) 10^{14}HZ

23. In x – rays tube the accelerating potential applied at the anode is V_o. Which of the following will be the minimum wavelength of the emitted x – rays?

(a) $\frac{ev_o}{h}$ (b) $\frac{h}{ev_o}$

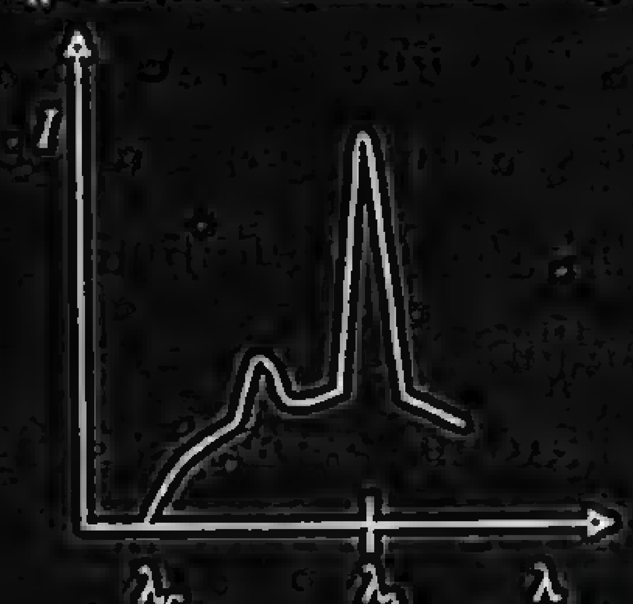
(c) $\frac{ev_o}{hc}$ (d) $\frac{hc}{ev_o}$

24. The difference between soft and hard x – rays is of

(a) velocity (b) frequency

(c) intensity (d) polarization

25. The intensity of x – rays from a Coolidge tube is plotted against wavelength λ as shown in the figure. The minimum wavelength found is λ_C and the wavelength of the K_α line is λ_K. As the accelerating voltage is increased



(a) $\lambda_K - \lambda_C$ increases (b) $\lambda_K - \lambda_C$ decreases

(c) λ_K increases (d) λ_K decreases

26. Electrons of mass m and charge e are accelerated through a potential difference V and strike the target of X – ray tube. Which of the following is the maximum speed of these electrons?

(a) $\sqrt{\frac{ev}{m}}$ (b) $\frac{ev}{m}$

(c) $\sqrt{\frac{2ve}{m}}$ (d) $\frac{ev^2}{m}$

27. X – rays are absorbed maximum by

(a) wood (b) copper

(c) steel (d) lead

28. Which of the following is the dimensional formula of Rhydberg's constant

(a) $[MLT^{-1}]$ (b) $[M^0LT^0]$

(c) $[M^0L^{-1}T^0]$ (d) $[ML^0T]$

29. Which of the following is the value of principle quantum number for an ionized atom?

(a) infinity (b) zero

(c) one (d) none of these

30. Which of the following is the ratio of the energies of hydrogen atom in its first to second excited state?

(a) $\frac{1}{4}$ (b) $\frac{4}{9}$

(c) $\frac{9}{4}$ (d) 4

31. Which of the following is the energy required (in ev) for ionizing an excited hydrogen atom?

(a) 13.6ev (b) more than 13.6ev

(c) 10.2ev (d) 3.4ev or less than it

Answer with Hints

No.	Correct Option	Answers	Hint
1	b	colliding electron can gain higher K.E due to increased mean free path leading to ionization of atoms	
2	d	electron, positive ions and negative ions	
3	b	second line of Balmes series	
4	c	$\frac{5}{9}$	$\frac{1}{\lambda_{min}} = R\left[\frac{1}{(2)^2} - \frac{1}{(\infty)^2}\right]$ $\frac{1}{\lambda_{min}} = \frac{R}{4}$

			$\lambda_{max} = \frac{4}{R}$ $\frac{1}{\lambda_{max}} = R\left[\frac{1}{(2)^2} - \frac{1}{(3)^2}\right]$ $\frac{1}{\lambda_{max}} = R\left[\frac{1}{4} + \frac{1}{9}\right]$ $\frac{1}{\lambda_{max}} = \frac{5R}{36}$ $\lambda_{max} = \frac{36}{5R}$ $\frac{\lambda_{min}}{\lambda_{max}} = \frac{5}{9}$
5	d	$5 \longrightarrow 4$	
6	b	1.6×10^{-19}J	K.E = $e\Delta v$ $= 1.6 \times 10^{-19} \times 100$J
7	c	K.E decreases, P.E increases	
8	a	$\frac{36}{5R}$	$\frac{1}{\lambda} = R\left[\frac{1}{(2)^2} - \frac{1}{(3)^2}\right]$ $\frac{1}{\lambda} = R\left[\frac{1}{4} - \frac{1}{9}\right]$ $\frac{1}{\lambda} = R\left[\frac{9-4}{36}\right]$ $\frac{1}{\lambda} = \frac{5R}{36}$ $\lambda = \frac{36}{5R}$
9	d	3.4ev	$E_n = \frac{13.6}{n^2}$ ev

			$= \frac{13.6}{(2)^2}$ ev $= 3.4$ev
10	a	Decreases	
11	d	$2n^2$	
12	c	$\frac{27}{32}\lambda$	$\frac{1}{\lambda} = R\left[\frac{1}{(1)^2} - \frac{1}{(2)^2}\right]$ $\frac{1}{\lambda} = \frac{3R}{4}$ $\lambda = \frac{4}{3R}$ $R = \frac{4}{3\lambda} \longrightarrow (1)$ $\frac{1}{\lambda'} = R\left[\frac{1}{(1)^2} - \frac{1}{(3)^2}\right]$ $\frac{1}{\lambda'} = \frac{8R}{9}$ $\lambda' = \frac{9}{8R}$ putting value of R from eq(1) $\lambda' = \frac{9\times3\lambda}{8\times4}$ $\lambda' = \frac{27}{32}\lambda$
13	c	$-\frac{1}{2}$	
14	d	increases four times	$E_n = n^2 r_1$
15	a	$V_4 = \frac{V_1}{4}$	$V_n = \frac{V_1}{n}$

16	a	$f = \frac{RC}{4}$	$\frac{1}{\lambda} = R\left[\frac{1}{(2)^2} - \frac{1}{(\infty)^2}\right]$ $\frac{1}{\lambda} = \frac{R}{4}$ $\lambda = \frac{4}{R}$ $\frac{C}{f} = \frac{4}{R}$ $f = \frac{RC}{4}$
17	c	$E^2 = P^2C^2$	
18	a	its energy levels are too close to each other	
19	b	voltage applied to tube	
20	d	increasing filament current	
21	c	$f = \frac{ev}{h}$	$E = ev$ $E = hf$ $hf = ev$ $f = \frac{ev}{h}$
22	a	10^{19} Hz	
23	d	$\frac{hc}{ev_o}$	$E = ev_o$ $E = \frac{hc}{\lambda}$ $\frac{hc}{\lambda} = ev_o$
24	b	Frequency	
25	a	$\lambda_K - \lambda_C$ increases	

26	c	$\sqrt{\frac{2ve}{m}}$	$\frac{1}{2}mu^2 = Ve$ $\sqrt{\frac{2ve}{m}}$
27	d	Lead	
28	c	$[M^0L^{-1}T^0]$	
29	a	Infinity	
30	c	$\frac{9}{4}$	$E_2 = \frac{-E_o}{4}$ $En = \frac{-E_o}{n^2}$ $E_3 = \frac{-E_o}{9}$ $\frac{E_2}{E_3} = \frac{\frac{-E_o}{4}}{\frac{-E_o}{9}}$ $= \frac{9}{4}$
31	d	3.4 ev or less than it	

Additional Short Questions

1. The total energy of the hydrogen orbits are negative. Why?

Ans. The negative sign show that the electron is bound to the nucleus by electrostatic force of attraction and that energy must be supplied to detach an electron from the nucleus.

2. How will you control the intensity and quality of x–rays?

Ans. The intensity of x–rays depends upon the number of electrons striking the target and depends upon the filament temperature which can be controlled by adjusting the current passing through filament. The quality of x–rays depends upon the penetrating power and can be controlled by adjusting the anode potential.

3. "Bohr's orbit are called stationary orbits." Why?

Ans. The electrons do not radiate energy while they revolve in the stationary orbits.

4. How the maximum energy of the x–rays emitted from an x–rays tube can be increased?

Ans. The higher the frequency of the x–rays the greater the energy per x–ray photon. The energy of electrons hiting the target can be increased by increasing the potential difference between anode and cathode and hence the frequency of emitted photon increases.

5. Why hydrogen atoms can not emit x–rays?

Ans. Hydrogen atom has only one electron in its K–shell. If this K–shell electron is knocked out, there is a vacancy in K–shell but no other electron is available in the higher shells which could fill the vacancy in K–shell. Therefore hydrogen atom can not emit x–rays.

6. Differentiate between characteristic x–rays and continuous x–rays?

Ans. The x–rays emitted from inner shell transition are called characteristic x–rays and their energy depends upon the type of target material.

The x–rays emitted having continuous ranges of frequencies due to bremsstrauhlung effect are called continuous x–rays.

7. What is meant by spectroscopy?

Ans. The branch of physics which deals with the production, measurement and interaction of electromagnetic radiation emitted or absorbed by atoms is called spectroscopy.

(Fsd 2005, Sgd 2005, Mir Pur 2007)

8. What is the difference between emission and absorption spectrum?

Ans. (i) In emission spectrum light or other radiation are emitted by a substance under particular circumstances that emission can be by high temperature or by bombardment with electrons.

(ii) In absorption spectrum a continuous flow of radiation is passed through the sample. The radiation is then analysed to determine which wavelengths are absorbed.

9. Name the different types of emission spectrum

Ans. These are three kinds of spectra which are:

(1) Continuous spectra, e.g. radiation spectrum of black body.
(2) Band spectra, e.g. molecular spectra.
(3) Line or discrete spectra, e.g. atomic spectra of hydrogen.

10. Why the atomic spectrum is also known as discrete spectrum?

Ans. Atomic spectrum is also known as discrete spectrum because it consists of discrete lines corresponding to single wavelength of resuming due to transition between.

11. In which regions of the electromagnetic spectrum does the hydrogen emission spectrum lie?

Ans. The electromagnetic spectrum of hydrogen emission spectrum lies in the following regions:

Ultraviolet region (UV), Visible region, infrared region (IR) and far infrared region.

pfund series lies in the infrared (IR) region.

12. How many electronic orbits are there in a hydrogen atom?

Ans. There are infinity orbits in a hydrogen atom. Only first orbit is occupied by one electron as there is single electron in hydrogen atom and remaining all orbits are vacant.

13. Discuss the draw backs in Rutherford atomic model?

Ans. According to Rutherford atomic model, an electron revolving around the nucleus should follow the spiral path due to continuous emission of energy and finally it should fall into the nucleus and also the emotion spectrum should be continuous. But that dost not happens.

14. Write the postulates of Bohr's atom model?

Ans. The postulates of Bohr's atomic model are:

(1) An electron can move around the nucleus in an orbit without radiating energy.

(2) The angular momentum of an electron in the orbit is given by integral multiple of $\frac{h}{2\pi}$ with n (principle equations) i.e.

$$mvr = n\frac{h}{2\pi} \quad \text{where } n = 1, 2, 3, \ldots\ldots$$

(3) Whenever an electron jumps from high energy state En to a lower energy state Ep then it emits light (i.e. Photon) energy given by

$$hf = E_n - Ep$$

15. Show that angular momentum and Planks constant have same units

Ans. As angular momentum is given by $\frac{nh}{2\pi}$ where n and 2π are constant having no unit so unit of $\frac{nh}{2\pi}$ is Js and that is also unit of Planks constant, so angular momentum and Plank's constants have same units.

16. What is difference between excitation and ionization energy?

Ans. **Excitation energy:** The energy required to lift an electron from ground state to any higher allowed state is called excitation energy.

Ionization energy: The energy required to completely remove an electron from the atom is called ionization energy.

The ionization energy of Hydrogen atom ground energy state is –13.6 eV.

17. Can the ionization energy for an electron in an atom have more than one value?

Ans. No, ionization energy for an electron in an atom has single value. However surplus energy can be converted into K.E. of emitted electrons.

18. What are X–rays?

Ans. X–rays are highly energy electromagnetic radiation discovered by Ratingen in 1895, which are produced when fast moving electrons strike a metal surface.

(Rwp 2005, Lhr 2008)

19. Why the inner shell transition is the basic requirement for the production of X–rays?

Ans. Inner shell transition is the basic requirement for production of X–rays because, because energy difference between inner shells be very much greater then the outer shells so the transition of inner shell electrons in heavy atoms gives rise to the emission of high energy photons or called X–rays.

20. What is the use to study the X-rays spectra?

Ans. The study of characteristics X–rays spectra has played a very important role in the study of atomic structure and periodic table of elements event. Energy identify the chemical element by mean of characteristic x-ray.

21. What do you mean by bremsstrahlung phenomenon?

Ans. Bremsstrahlung is German word meaning to stop or break. Thus bremsstrahlung phenomenon is that in which continuous spectrum is obtained due to breaking radiation i.e. by decleration of impacting electrons by a heavy target.

22. What is inner shell transition of electron?

Ans. In heavy atoms, the electrons are assumed to be arranged in concentric shells labeled K, L, M, N, O, etc. The K-shell being closest to the nucleus, the L-shell next and so on. The inner shell electrons are tightly bound to the nucleus and large amount of energy is required for their displacement from their normal energy levels. But when they are displaced to higher energy levels, on de-excitation they emit photons of very high energy. Transitions from these inner shells in heavy atoms are known as inner shell transitions.

23. Give some uses of x-rays

Ans. (i) X–rays are used in medical diagnostic and treatment.

(ii) X–rays are used at custom and security posts to detect arms, explosive materials and contraband goods.

(iii) X–rays are used to make X-ray picture of the bones and to locate bone fractures.

(iv) X–rays are widely used in industry. **(Lhr 2008)**

24. Write some properties of X–ray

Ans. (i) X–rays travel in straight line with velocity of light.

(ii) X–rays are not deflected by electric and magnetic field so these are chargeless.

(iii) X–rays can cause ionization in gases.

(iv) X–rays can produce fluorescence in many substances like zinc sulphide.

25. What is the basic difference between x-rays and Gamma rays?

Ans. X-rays are produced by stopping high energy electrons on heavy atoms whereas X-rays are produced due to radiactive decay of nuclei. Thus the source of origin for both is different. **(Lhr 2003, Federal 2005)**

26. Name the reverse process of X–ray production?

Ans. The reverse process of X–rays production is Photo electric effect.

27. What is meant by CAT scanner?

Ans. It is basically, consists of X-rays source with several hundred oppositely adjusted detectors. Each detector measures absorption of X-rays along a thin line through the subject. The entire system is linked through a computer that is why it is named as computerized axial tomography (CAT) and is widely used as a source of medical diagnostic. **(Mir Pur 2005, Lhr 2008)**

28. How does the uncertainty principle be useful to describe the existence of the electron in an atom?

Ans. By using uncertainty principle, it is verified that existence of the electron is in an atom but outside the nucleus. The exist the electron with in the nucleus it should have the speed greater then the speed of light would is not partially possible, so the electron exist inside an atom but outside the nucleus.

29. What is the difference between spontaneous and stimulated emission?

Ans. **Spontaneous emission:** As excited is highly instable state with life time of 10sec, so the electron will de excite itself with emission of photon in any arbitrary direction is called spontaneous emission.

Stimulated emission: If atom sat in excited (metastable) for a longer life time of about 10^{3}sec then an incident photon of ener equal to energy to difference of two energy levels. induces the atom to decay by emitting a photon that travel in

the direction of incident photon. This process is called stimulated or induced emission.

(Bwp 2005-2007)

30. Why the spontaneous emission is not too much suitable for the production of laser?

Ans. In spontaneous emission de-excited atom emits a proton of energy in any arbitrary direction so the photo coherence an never be obtained it is not suitable for the production of laser.

31. What is meta stable state? What role do such states play in the operation of laser?

Ans. A melastable state is an excited state in which an excited electron is unusually more stable and from which the electrons come to lower state after relatively longer time.

It plays important role in the operation of laser because phase coherence can be obtained by this way.

(Lhr 2009)

32. Differentiate between the terms normal population and population inversion.

Ans. **Normal population:** It is that state of an atom when there are more number of electrons in the lower energy state than in the excited state.

Population inversion: It is the state of an atom, when there are more number of excited electrons in the higher energy state than the lower energy state.

33. Give some uses of laser

Ans.
(i) Laser beams are used as a surgical tool for welding detached retinas.
(ii) Fine focused beam of laser has been used to destroy cancerous and pre-cancerous cell.
(iii) The precise straightness of laser beam is also useful to surveyor for lining up equipment.
(iv) It is potential energy source for inducing fusion reaction.
(v) It can be use for telecommunication in fibre optical. (Lhr 2008)

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. Atomic spectra are the examples of ________ spectra.
(a) Continuous (b) Line (c) Band (d) Mix
2. Production of X-rays can be regarded as the inverse of:
(a) Compton effect (b) Pair production
(c) Photo electric effect (d) Annihilation of matter
3. Which of the following series of H-Spectrum lies in ultraviolet region:
(a) Lyman series (b) Balmer series
(c) Paschen series (d) Bracket series
4. For holography we use a beam of:
(a) γ – rays (b) X-rays (c) α-rays (d) LASER
5. Electrons reside in the excited state about
(a) 10^{-3} s (b) 10^{-5} s (c) 10^{-8} s (d) 10^{-11} s
6. What is the colour of light emitted from He-Ne laser
(a) blue (b) green (c) red (d) yellow
7. The diameter of an atom is of the order of
(a) 10^{-12} m (b) 10^{-11} m (c) 10^{-10} m (d) 10^{-8} m
8. In the spectrum of which of the following will you find Balmer series
(a) oxygen (b) nitrogen (c) hydrogen (d) all of these
9. The emission of x-rays leaves the atom of the target in
(a) ground state (b) excited state
(c) doubly ionized state (d) singly ionized state
10. X-rays photon moves with the velocity of
(a) light (b) less than light (c) greater than light (d) sound
11. Laser can only be produced if an atom is in its

(a) normal state (b) excited state (c) ionized state (d) de-excited state

12. When an electron in hydrogen atom jumps from higher orbit into the first orbit, the set of line emitted are called
(a) Balmer series (b) Lyman series
(c) Bracket series (d) Paschen series

13. X-rays are similar in nature to
(a) alpha rays (b) beta rays (c) cathode rays (d) gamma rays

14. X-rays are electromagnetic radiations having wavelength in the range
(a) 10^{-12} m (b) 10^{-10} m (c) 10^{-8} m (d) 10^{-6} m

15. The rest mass of x-ray photon is
(a) 9.1×10^{-3} Kg (b) 1.67×10^{-27} Kg (c) zero (d) smaller than light photon

16. The reverse phenomenon of photoelectric effect is known as
(a) radioactivity (b) Compton effect
(c) x-rays effect (d) pair production

17. The relation between Rydberg constant R_H and ground state energy E_o is given by
(a) $R_H = E_o/hc$ (b) $R_H = hc/E_o$ (c) $E_o = R_H/hc$ (d) $R_H = E_o hc$

18. Balmer series lies in the
(a) ultraviolet region (b) far ultraviolet region
(c) infrared region (d) visible region

19. The radius of 3^{rd} Bohr orbit in hydrogen atom is greater than the radius of 1^{st} orbit by a factor of
(a) 2 (b) 3 (c) 4 (d) 9

20. X-ray diffraction implies that radiation has a
(a) particle nature (b) wave nature (c) wave particle nature (d) none of these

21. The value of Rydburg constant is
(a) $1.0974 \times 10^{7}\ m^{-1}$ (b) $1.0794 \times 10^{7}\ m^{-1}$ (c) $1.0974 \times 10^{9}\ m^{-1}$ (d) $1.974 \times 10^{9}\ m^{-1}$

22. In lasers, the metastable state of the order of
(a) 10^{-3} s (b) 10^{-6} s (c) 10^{-8} s (d) 10^{-10} s

Answers Key:

1.	(b) Line	12.	(b) Lyman series
2.	(c) Photo electric effect	13.	(d) gamma rays
3.	(a) Lyman series	14.	(b) 10^{-10} m
4.	(d) LASER	15.	(c) zero
5.	(c) 10^{-8} s	16.	(c) x-rays effect
6.	(c) red	17.	(a) $R_H = E_o/hc$
7.	(b) 10^{-11} m	18.	(d) visible region
8.	(c) hydrogen	19.	(d) 9
9.	(a) ground state	20.	(b) wave nature
10.	(a) light	21.	(a) $1.0974 \times 10^{7}\ m^{-1}$
11.	(b) excited state	22.	(a) 10^{-3} s

Chapter 21 NUCLEAR PHYSICS

Topic Wise MCQ's

♦ Four possible answers to each statement are given below. Tick (✓) the correct answer:

Atomic Nucleus, Isotopes

1. The branch of physics which deals with the study of atomic nucleus and sub-atomic particles is called
   (a) atomic physics (b) nuclear physics
   (c) quantum physics (d) solid state physics
2. The central part of an atom is called
   (a) meson (b) electron
   (c) positron (d) nucleus
3. Proton was discovered by
   (a) Dalton (b) Chadwick
   (c) Rutherford (d) Thomson
4. Proton was discovered in
   (a) 1910 (b) 1915
   (c) 1920 (d) 1925
5. Neutron was discovered by
   (a) Chadwick (b) Rutherford
   (c) Thomson (d) Dalton
6. Neutron was discovered in
   (a) 1920 (b) 1932
   (c) 1906 (d) 1928

Chapter 21 NUCLEAR PHYSICS

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   (c) Thomson (d) Dalton
6. Neutron was discovered in
   (a) 1920 (b) 1932
   (c) 1906 (d) 1928

7. What %age of mass of atom is concentrated in the nucleus?
(a) 99.9% (b) 9.9%
(c) 99% (d) 9%

8. Mass of neutron is
(a) 1.67×10^{-19} C (b) 1.67×10^{-27} kg
(c) 1.67×10^{-31} kg (d) 1.67×10^{-35} kg

9. Charge on proton is
(a) 1.6×10^{-19} C (b) 1.6×10^{-27} kg
(c) 1.6×10^{-31} kg (d) zero

10. Mass of proton is
(a) 1.67×10^{-19} kg (b) 1.67×10^{-27} kg
(c) 1.67×10^{-31} kg (d) 1.67×10^{-35} kg

11. Charge on electron is:
(a) $+1.6 \times 10^{-19}$ C (b) -1.6×10^{-19} C
(c) $+1.6 \times 10^{-27}$ C (d) -1.6×10^{-27} C

12. Electron was discovered in 1891 by
(a) Millikan (b) Rutherford
(c) Chadwick (d) J. J. Thomson

13. Mass of the proton is of the order of
(a) 10^{-19} kg (b) 10^{19} kg
(c) 10^{-27} kg (d) 10^{-31} kg

14. Mass of neutron is of the order of
(a) 10^{-19} kg (b) 10^{-27} kg
(c) 10^{-31} kg (d) None of these

15. The diameter (size) of an atom is of the order of
(a) 10^{10} m (b) 10^{-10} m
(c) 10^{14} m (d) 10^{-14} m

16. The diameter (size) of the nucleus is of the order of
(a) 10^{10} m (b) 10^{-10} m
(c) 10^{14} m (d) 10^{-14} m

17. Nucleus consists of
(a) electron and proton

(b) electron and neutron
(c) proton and neutron
(d) electron, proton and neutron

18. A particle having the mass of electron and charge of proton is called a
(a) meson (b) lepton
(c) positron (d) photon

19. 1u = ____________
(a) 1.66×10^{-19} kg (b) 1.66×10^{-27} kg
(c) 1.66×10^{-31} kg (d) 1.66×10^{-35} kg

20. 1u (unified mass scale) is equivalent to
(a) 785 MeV (b) 880 MeV
(c) 900 MeV (d) 931 MeV

21. Total charge on any nucleus is
(a) Ze (b) Z/e
(c) Ae (d) Ne

22. In heavier elements
(a) N = Z (b) N > Z
(c) N < Z (d) $N \leq Z$

23. Xenon has 36 isotope while cesium has ________ isotopes
(a) 12 (b) 24
(c) 36 (d) none of these

24. The number of protons or electrons in an atom is called
(a) Atomic number (b) Charge number
(c) Both of above (d) None of these

25. The total number of protons and neutron in a nucleus is called
(a) mass number (b) charge number
(c) atomic number (d) none of these

26. The number of protons in any atom are always equal to its number of
(a) neutrons (b) electrons
(c) positrons (d) photons

27. The number of neutrons in any nucleus can be given by
(a) N = A + Z (b) N = Z − A
(c) N = A − Z (d) $N = \frac{A}{Z}$

28. The number of neutrons in the nucleus of $^{235}_{92}U$ are
(a) 92 (b) 235

(c) 143 (d) none of these

29. Structure of the nucleus was explained by
(a) Rutherford (b) Bohr
(c) Millikan (d) Thomson

30. Nuclei of different elements are identified by their
(a) Atomic mass number (b) Atomic number
(c) Nuclear number (d) Nuclear charge

31. Nuclei having same charge number but different mass number are called
(a) Isobars (b) Isotopes
(c) Isotones (d) Isomers

32. The number of isotopes of hydrogen are
(a) 1 (b) 2
(c) 3 (d) 4

33. Isotopes of the nucleus of uranium are:
(a) $^{234}_{92}U$ (b) $^{235}_{92}U$
(c) $^{238}_{92}U$ (d) All of these

34. The isotope $^{1}_{1}H$ contain
(a) One neutron (b) Two neutron
(c) No neutron (d) Three neutron

35. Hydrogen atom with only one proton in its nucleus and one electron in its orbit is called:
(a) Deuteron (b) Deuterium
(c) Protium (d) Tritium

36. Hydrogen atom with only one proton and one neutron in its nucleus and one electron in its orbit is called
(a) Deuterium (b) Protium
(c) Tritium (d) None of these

37. Hydrogen atom with only one proton and two neutrons in its nucleus and one electron in its orbit is called
(a) Protium (b) Deuterium
(c) Deuteron (d) Tritium

38. The chemical properties of all the isotopes of an element are
(a) Same (b) Different
(c) Slightly different (d) None of these

39. The chemical properties of an element depends upon the number of

(a) Electrons (b) Neutrons
(c) Proton (d) Positrons

40. The chemical behaviour of an atom is determined by
(a) Mass number (b) Number of isotopes
(c) Atomic number (d) Nucleus

41. Both Xenon and cesium each have isotopes
(a) 12 (b) 22
(c) 32 (d) 36

42. Isotopes of the nucleus of hydrogen are
(a) $^{1}_{1}H$ (b) $^{2}_{1}H$
(c) $^{3}_{1}H$ (d) All of these

43. The number of isotopes of helium are
(a) 2 (b) 3
(c) 4 (d) 6

Mass Spectrograph, Mass Defect And Binding Energy

44. Mass spectrograph is used to determine
(a) isotopes (b) number of protons
(c) number of neutrons (d) number of electrons

45. In a mass spectrograph, the mass of each ion reaching the detector is proportional to
(a) B^2 (b) $1/B^2$
(c) $\sqrt{B}$ (d) $1/\sqrt{B}$

46. Thee most abundant isotope of neon is
(a) Neon-20 (b) Neon-21
(c) Neon-22 (d) Neon-23

47. Neon gas have three isotopes whose atomic number are
(a) 21, 22, 23 (b) 20, 22, 24
(c) 24, 25, 26 (d) 20, 21, 22

48. The mass of the nucleus is always less than the total mass of the protons and neutrons that make up the nucleus. The difference of the two masses is called
(a) binding energy (b) energy defect
(c) mass defect (d) momentum defect

49. Mass spectrograph can be used to
(a) separate the different isotope of an element
(b) find the mass of isotopes of an element

(c) determine the abundance of mass each isotope of an element
(d) all of these

50. If A= 235 and Z= 92, then number of neutrons in the nucleus is
(a) 51 (b) 143
(c) 92 (d) 235

51. The amount of energy required to break the nucleus is called the
(a) potential energy (b) kinetic energy
(c) nuclear energy (d) binding energy

52. The missing mass which is converted to energy in the formation of nucleus is called
(a) mass defect (b) binding energy
(c) nuclear energy (d) none of these

53. 1u= ________
(a) 1/12 of ^{12}C (b) 1/12 of ^{14}C
(c) 1/6 of ^{12}C (d) 1/6 of ^{14}C

54. In mass spectrograph, the atoms or molecules of the element under investigation are
(a) in vapours form (b) ionized positively
(c) ionized negatively (d) both a and b

55. The sum of the masses of constituent nucleons as compared to the mass of the resultant nucleus is
(a) smaller (b) greater
(c) the same
(d) sometimes smaller, some times greater

56. The binding energy per nucleon is
(a) greater for heavy nuclei (b) least for heavy nuclei
(c) greater for light nuclei
(d) greater for medium weight nuclei

57. Unified mass scale is a scale based upon the mass of carbon atom taken exactly to be
(a) 10 u (b) 12 u
(c) 14 u (d) 16 u

58. Mass number is the combined number of
(a) netron,proton, electron (b) proton, electron
(c) netron,proton (d) netron,proton, positron

Radioactivity, Half Life

59. The phenomenon of neutral radioactivity was discovered by
(a) Madam Curie (b) Sir Chadwick
(c) Rutherford (d) Henry Becquerel

60. Radioactivity was discovered in

(a) 1896 (b) 1906
(c) 1894 (d) 1898

In alpha decay,
(a) parent and daughter nuclei have same number of protons
(b) daughter nucleus has one proton more than parent nucleus
(c) daughter nucleus has two protons less than parent nucleus
(d) daughter nucleus has one neutron less than parent nucleus

The most stable element is
(a) copper (b) uranium
(c) iron (d) cobalt

Marie Curie and Pierre Curie discovered two new radioactive elements which are
(a) uranium and radium (b) polonium and radium
(c) platinum and radium (d) polonium and uranium

Radioactivity happens due to the disintegration of
(a) neutron (b) nucleus
(c) protons (d) electrons

In beta decay, which one of the following reactions takes place
(a) ${}^1_0n \Rightarrow {}^1_1H + {}^0_1e$ (b) ${}^3_1H \rightarrow {}^1_0n + {}^0_{-1}e$
(c) ${}^1_0n \Rightarrow {}^2_1H + {}^0_{-1}e$ (d) ${}^1_0n \rightarrow {}^1_1H + {}^0_{-1}e$

α, β and γ rays are emitted from a radioactive substances
(a) spontaneously (b) when it is heated
(c) when it is exposed to light (d) none of these

Alpha (α) particles are
(a) electrons (b) photons
(c) hydrogen nuclei (d) helium nuclei

Beta (β) particles are:
(a) electrons (b) photons
(c) hydrogen nuclei (d) helium nuclei

Gamma (γ) rays consists of stream of
(a) electrons (b) protons
(c) photons (d) all of these

The elements showing radioactivity have atomic number Z
(a) Z > 50 (b) Z < 82
(c) Z > 82 (d) Z < 70

Artificial radioactivity was discovered by
(a) Becquerel (b) Maxwell

(c) Curie (d) none of these

72. Curie is a unit of
(a) conductivity (b) resistivity
(c) binding energy (d) radioactivity

73. When a nucleus emits an alpha particle, its atomic mass decreases by:
(a) 1 (b) 2
(c) 3 (d) 4

74. When a nucleus emits alpha particle, its charge number decreases by
(a) 2 (b) 3
(c) 5 (d) 6

75. β-particles carries a charge
(a) −e (b) +4e
(c) +2e (d) −2e

76. Gamma rays carriers a charge
(a) −e (b) +e
(c) −2e (d) no charge

77. The rate of decay of radioactive substance
(a) is constant
(b) decreases exponentially with time
(c) varies inversely as time
(d) decreases linearly with time

78. When a nucleus emits β-particle its mass number remains constant but charge number increases by:
(a) 1 (b) 2
(c) 3 (d) 4

79. If half life of a radioactive is one year, what percentage of the sample decays after two years?
(a) 25% (b) 50%
(c) 12.5% (d) 75%

80. The time required for a radioactive material to decrease in activity by one half is called:
(a) half time (b) half life
(c) mean life (d) disintegration time

81. The half life of a radioactive element is given by:
(a) $T_{1/2} = 0.603\,\lambda$ (b) $T_{1/2} = 0.693/\lambda$
(c) $T_{1/2} = 0.93/\lambda$ (d) $T_{1/2} = 0.698\,\lambda$

82. In the equation, $\Delta N = -\lambda \Delta t$, λ is called

(a) wavelength (b) decaying element
(c) decay constant (d) all of these

83. The SI unit of decay constant is
(a) m (b) m^{-1}
(c) S^{-1} (d) ms^{-1}

84. Product of half life($T_{1/2}$) and decay constant (λ) of a radioactive element is
(a) 1 (b) 0.693
(c) 0.963 (d) 0.639

85. The half life of radioactive depend upon
(a) temperature (b) pressure
(c) amount of radioactive substance (d) nature of element

86. All the radioactive materials have the
(a) Different half lives (b) Same half lives
(c) Infinite half lives (d) None of these

87. The disintegration of one element into another is called
(a) disintegration decay (b) half life
(c) permutation (d) all of these

88. Fraction of the decaying atoms per unit time is called
(a) decay atom (b) decay element
(c) decay constant (d) decay

89. s^{-1} is not the unit of
(a) frequency (b) decay constant
(c) time period (d) both a and c

90. If N_o is the original number of atoms of radioactive element, then the number of undecayed atoms after two half lives is
(a) ¼ N_o (b) ½ N_o
(c) ¾ N_o (d) None of these

91. The radio active process is
(a) random process (b) affected chemically
(c) nuclear phenomenon (d) Both a and c

92. If half life of a radioactive element is one year, percentage of sample decays after two years is
(a) 50% (b) 75%
(c) 25% (d) none

93. Thermal neutrons can cause fission in
(a) ^{235}U (b) ^{238}U

(c) ^{239}Pu (d) ^{232}Th

94. In radioactive decay, the original element which disintegrates to another element is called
(a) parent element (b) daughter element
(c) product element (d) none of these

95. Complete the equation for the following fission reaction

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{90}_{38}Sr + ^{140}_{54}Xe + \_\_ + \text{energy}$$

(a) neutron (b) proton
(c) 2netron (d) proton and neutron

96. Which one of the following material has smaller half life?
(a) radium (b) radon
(c) uranium-238 (d) uranium-239

Interaction Of Radiations With Matter

97. The distance traveled by α-particle in a medium before coming to rest, is called
(a) velocity of particle (b) acceleration of particle
(c) range of particle (d) all of these

98. The range of particle depends upon the factor
(a) charge, mass and energy of particle
(b) density of medium
(c) ionization potential of the atoms
(d) all of these

99. How much times, the α-particle more massive than an electron?
(a) 6000 (b) 7000
(c) 8000 (d) 9000

100. The main interaction of radiation with matter is
(a) ionization (b) polarization
(c) excitation (d) all of these

101. The range of β-particles in air is greater than that of α-particles by:
(a) 10 times (b) 50 times
(c) 100 times (d) 200 times

102. The penetrating power of β-particle is:
(a) zero (b) less than α-particle
(c) greater than α-particle (d) equal to α-particle

103. γ-rays are:
(a) mechanical waves (b) electromagnetic waves
(c) longitudinal waves (d) sound waves

104. Which one of the following can produce little ionization?
(a) neutrons (b) x-rays
(c) β-rays (d) γ-rays

105. Pair production take place when energy of γ-rays photon is:
(a) less than 1.02 MeV (b) greater than 1.02 MeV
(c) equal to 1.02 eV (d) none of these

106. Photoelectric effect take place when energy of γ-rays:
(a) less than 0.5 MeV (b) greater than 0.5 MeV
(c) equal to 0.5 MeV (d) none of these

107. β-particle is regarded as fast moving
(a) electrons (b) protons
(c) neutrons (d) positron

108. The ionization power of α-particle is
(a) equal to β-particle (b) equal to γ-particle
(c) greater than β-particle (d) less than β-particle

109. The ionization power of β-particle is
(a) Equal to α-particle (b) equal to γ-particle
(c) greater than α-particle (d) less than α-particle

110. Which of the following is not affected by the electric or magnetic field?
(a) α-rays (b) β-rays
(c) γ-rays (d) All of these

111. γ-rays are electromagnetic waves like
(a) x-rays (b) light waves
(c) heat waves (d) all of these

112. Charged particles α or β and γ radiation produce fluorescence in
(a) zinc sulphide (b) sodium iodide
(c) barium platinocynaide (d) all of these

113. The intensity 'I_o' of a beam after passing through a distance 'x' in the medium is reduced to intensity 'I' given by the relation
(a) $I = I_o e^{\mu x}$ (b) $I_o = Ie^{\mu x}$
(c) $I = -I_o e^{-\mu x}$ (d) $I_o = -Ie^{\mu x}$

Radiation Detectors

114. Radiation detectors are used to
(a) measure range or penetration power of ionizing particles
(b) measure energy of radiation
(c) detect different types of radiation

(d) all of these

115. When a charged particle passes through matter, it produces ionization, this effect is used in
(a) reactor (b) fission reaction
(c) fusion reaction (d) radiation detector

116. Which one of the following is a radiation detector?
(a) solid state detector (b) Wilson cloud chamber
(c) Geiger Muller counter (d) all of these

117. By placing Wilson cloud chamber is strong magnetic field we can get information about ________ of incident particle
(a) energy (b) charge
(c) mass (d) all of these

118. Cloud chamber was invented by
(a) Muller (b) Rutherford
(c) Lawrence (d) C.T.R. Wilson

119. Wilson cloud chamber is based on the principle that supersaturated vapors condense more readily on
(a) dust particles only (b) ions only
(c) ions and dust particles (d) neither dust particles nor ions

120. A Wilson cloud chamber uses
(a) super heated liquid (b) vapours
(c) supersaturated vapours (d) saturated vapours

121. In Wilson cloud chamber, track of α-particles is
(a) thick (b) straight
(c) continuous (d) all of these

122. In Wilson cloud chamber, track of β-particles is
(a) thin and discontinuous (b) erratic
(c) frequent deflected (d) all of these

123. Track of γ-rays is
(a) irregular (b) straight
(c) thick (d) continuous

124. When an α-particle collides with an atom of a gas, it knocks out
(a) neutrons (b) protons
(c) electrons (d) positrons

125. Geiger Muller counter is not used for
(a) slow counting (b) fast counting
(c) both slow and fast counting (d) none of these

126. The thin wire in the centre of G.M. tube is
(a) negatively charged (b) positively charged
(c) neutral (d) none of these

127. The thin wire at the centre of G.M. tube act as
(a) cathode (b) anode
(c) neutral (d) none of these

128. Quenching of discharge means making the gas
(a) conducting (b) saturated
(c) both conducting and saturated (d) non-conducting

129. G.M. counter uses
(a) alcohol only (b) bromine
(c) argon (d) neon and bromine

130. G.M. counter is not suitable for
(a) α-particles counting (b) γ-rays counting
(c) ion counting (d) fast counting

131. The potential difference between anode and cathode in a neon-bromine filled G.M. counter is
(a) 220 V (b) 200 V
(c) 300 V (d) 400 V

132. In G.M. counter, the electrons take time to reach the anode
(a) 1 μs (b) 2 μs
(c) 10^{-3} s (d) 10^{-4} s

133. In G.M. counter, the positive ions take time to reach the cathode
(a) 1 μs (b) 2 μs
(c) 10^{-3} s (d) 10^{-4} s

134. The potential difference between the top and bottom of a cloud chamber is of the order of
(a) 2 kV (b) 1 kV
(c) 3 kV (d) 4 kV

135. In GM-counter the quenching gas must have an ionization potential _____ that of principle gas
(a) equal to (b) less than
(c) greater then (d) much greater then

136. The solid state detectors is a p-n junction which operates at the
(a) forward bias (b) reverse bias
(c) both (a) and (b) (d) none of these

137. Solid state detector with amplifier can be used to detect
(a) α-rays (b) β-rays
(c) γ-rays (d) None of these

138. Solid state detector is
(a) efficient (b) accurate
(c) fast (d) all of these

139. A solid state detector mainly consists of a
(a) Silicon diode (b) Transistor
(c) Germanium crystal (d) All of these

140. The energy needed to create an electron-hole pair in a solid state detector is
(a) 1 eV - 2 eV (b) 2 eV - 3 eV
(c) 3 eV - 4 eV (d) 4 eV - 5 eV

141. A detector which can count fast and operate at low voltage is
(a) G.M. counter (b) solid state detector
(c) Wilson cloud chamber (d) bubble chamber

Nuclear Reactions, Nuclear Fission, Fusion Reaction

142. Disintegration of nucleus obeys the laws of conservation of
(a) charge only (b) mass only
(c) both charge and mass (d) none of these

143. The process of nuclear fission was explained by
(a) Strassman (b) Otto Hahn
(c) Strassmass and Otto Hahn (d) Bohr and Wheeler

144. The fission of uranium
(a) does not always produce the same fragments
(b) always produces the same fragments
(c) always produces the different fragments
(d) All of these

145. The most important and the vital part of a reactor is
(a) core (b) moderators
(c) control rods (d) all of these

146. Fission chain reaction is controlled by introducing
(a) iron rods (b) cadmium rods
(c) graphite rods (d) all of these

147. The process by which a heavy nucleus splits into two lighter nuclei is called
(a) fission (b) fusion
(c) decay (d) annihilation

148. Atomic bomb depends upon the process of

(a) ionization (b) excitation
(c) fission (d) fusion

149. The average amount of energy produced during fission process of $^{235}_{92}U$ is about
(a) 100 MeV (b) 200 MeV
(c) 300 MeV (d) 400 MeV

150. In Karachi Nuclear power plant (KANUP) ______ is used as moderator.
(a) water (b) carbon
(c) Heavy water (d) graphite

151. Heavy water is used as moderator in a nuclear reactor. The function of moderator is
(a) control the energy released in the reactor
(b) absorb neutron and stop chain reaction
(c) cool the reactor
(d) slow down the neutron to thermal energies

152. For fission to occur, neutrons must posses
(a) Low energy (b) High energy
(c) Thermal energy (d) Chemical energy

153. The energy released in the nuclear fission appears in the form of
(a) K.E. of fragments (b) P.E. of fragments
(c) both a and b (d) light

154. The minimum mass of fissionable material for self-sustaining chain reactor is called
(a) the nuclear mass (b) the critical mass
(c) the atomic mass (d) All of these

155. In the fission of ^{235}U, ______ energy per nucleon is emitted.
(a) 200 MeV (b) 7.7 MeV
(c) 0.9 MeV (d) 8.5 MeV

156. Average number of neutrons produced in each fission reaction are
(a) 6 (b) 3
(c) 5 (d) 4

157. When ^{235}U undergoes fission, 0.1 % of its original mass is changed into energy. How much energy is released if 1kg of ^{235}U undergoes fission?
[Hint: $E=mc^2$, $m = 0.1$ % of 1kg $= 0.1/100 = 1 \times 10^{-3}$ kg]
(a) 3×10^{5} J (b) 9×10^{13} J
(c) 9×10^{5} J (d) 200MeV

158. The LMFBR (fast reactor) reactor utilizes
(a) $^{234}_{92}U$ (b) $^{235}_{92}U$

(c) $^{238}_{92}U$ (d) $^{239}_{92}U$

159. The moderators used in fast reactor is:
(a) water (b) sodium
(c) graphite (d) no moderator

160. The working principle of LMFBR (fast reactor) is to convert $^{238}_{92}U$ into
(a) $^{235}_{92}U$ (b) $^{239}_{92}U$
(c) $^{239}_{94}Pu$ (d) All of these

161. The uncontrolled fission chain reaction results into the formation is
(a) nuclear bomb (b) hydrogen bomb
(c) cobalt bomb (d) none of these

162. In the reaction $X + ^{17}_{8}O \rightarrow ^{14}_{7}N + ^{4}_{2}He$, X is?
(a) $^{1}_{1}H$ (b) $^{2}_{1}H$
(c) $^{1}_{0}n$ (d) $^{0}_{-1}e$

163. In the reaction $^{X}_{4}Be + ^{4}_{2}He \rightarrow ^{12}_{6}C + ^{1}_{0}n$, X is?
(a) 7 (b) 9
(c) 8 (d) 10

164. Natural uranium is a low grade fuel, it is due to high percentage of
(a) $^{238}_{92}U$ (b) $^{235}_{92}U$
(c) $^{234}_{92}U$ (d) none of these

165. The binding energy per nucleus for uranium is about
(a) 8.5MeV (b) 7.7 MeV
(c) 28 MeV (d) 200 MeV

166. Release of fission energy results because of destruction of
(a) gravitational force in the nucleus
(b) electrostatic force in the nucleus
(c) mass in the nucleus
(d) none of these

167. In fission reaction, heavy water is used as a
(a) coolant (b) moderator
(c) heat exchanger (d) all of these

168. In nuclear fission, the masses of product nuclei are always
(a) equal to the masses of reactant nuclei
(b) less than the masses of reactant nuclei
(c) greater than the masses of reactant nuclei
(d) none of these

169. PWR stands for
(a) pressurize wind reactor (b) pressurize water reactor
(c) power wind reactor (d) none of these

170. During fission process, the energy release per nucleon is about
(a) 1 MeV (b) 2 MeV
(c) 3 MeV (d) 4 MeV

171. The process in which two or more light nuclei combine together to form heavier nuclei with release of energy is called
(a) fission reaction (b) fusion reaction
(c) chain reaction (d) chemical reaction

172. The source of energy in the sum and the stars is mainly due to
(a) fission reaction (b) fusion reaction
(c) chain reaction (d) chemical reaction

173. In fusion reaction, when two deuterons are merged to form helium nucleus, the energy released is
(a) 20 MeV (b) 24 MeV
(c) 100 MeV (d) 200 MeV

174. Hydrogen bomb is an example of
(a) fission reaction (b) fusion reaction
(c) chemical reaction (d) chain reaction

175. When two deuterium nuclei fuse together to form a tritium nucleus, we get a
(a) proton (b) neutron
(c) alpha particle (d) electron

176. In fusion reaction, the energy released per nucleon is about (in p-p chain reaction)
(a) 2 MeV (b) 5 MeV
(c) 15 MeV (d) 6.4 MeV

177. The source of solar energy is mainly due to
(a) fission (b) fusion
(c) pair production (d) all of these

178. Ultra violet rays can cause
(a) sunburn (b) skin cancer
(c) severe crop damage (d) All of these

179. To start a fusion reaction, the temperature required is about
(a) 10^6 °C (b) 10^7 °C
(c) 10^9 °C (d) 10^{12} °C

Radiation Exposure, Biological Of Radiation, Biological And Medical Uses Of Radiation

180. Radioactive ______ gas enters building from ground.
(a) radium (b) radon
(c) chlorine (d) Both b and c
181. Thyroid cancer is cured by
(a) cesium-137 (b) sodium-24
(c) iodine-131 (d) cobalt-60
182. The most useful tracer is
(a) carbon-12 (b) carbon-14
(c) Potassium-39 (d) none of these
183. Radiotherapy is often used in the treatment of cancer with:
(a) iodine-131 (b) sodium-34
(c) carbon-12 (d) cobalt-60
184. Radioactive iodine-131 is used to combat cancer of the
(a) heart (b) liver
(c) kidney (d) thyroid gland
185. Which of the following particle has the greatest relative biological?
(a) x-rays (b) α-particles
(c) neutrons (d) β-particles
186. Various types of cancer are treated by
(a) carbon-14 (b) cobalt-60
(c) nickel-63 (d) cesium-137
187. Coloured television sets and microwave ovens emit
(a) α-rays (b) β-rays
(c) γ-rays (d) X-rays
188. Cosmic rays consists of
(a) protons (b) positrons
(c) high energy photons (d) all of these
189. The cosmic radiations consists of
(a) low energy charged particles
(b) high energy charged particles
(c) electromagnetic radiation

(d) high energy charged particles and electromagnetic radiation
190. Radioactive traces are also employed to follow the path that various chemicals or food constituents taken in
(a) plants (b) animals
(c) human bodies (d) all of these
191. The tumors are traced by using
(a) α-particles (b) β-particles
(c) γ-rays (d) all of these
192. Cancerous tissues in a thyroid gland can be detected by the intake of
(a) radio sodium (b) radio iodine
(c) radio carbon (d) all of these
193. The gamma camera is designed to detect
(a) α-radiation (b) β-radiation
(c) γ-radiation (d) x-rays
194. The γ-rays radiographs are used in
(a) agricultural industry (b) medical diagnosis
(c) sports industry (d) all of these
195. Film badge dosimeter are used to monitor radiation in:
(a) nuclear facilities (b) operation theaters
(c) educational facilities (d) aviation facilities
196. The SI unit of radiation dose is
(a) gray (b) becquerel
(c) henry (d) rem
197. One joule of energy absorbed per kilogram of body is
(a) rem (b) gray
(c) becquerel (d) rontgen
198. Strength of radiation source is measured in
(a) becquerel (b) rem
(c) gray (d) joule
199. The quantity called absorbed radiation dose 'D' is defined as
(a) $D = \frac{E}{m}$ (b) $D = \frac{E}{c}$
(c) $D = \frac{m}{E}$ (d) $D = \frac{E}{c}$
200. The safe limit dose for persons working in a nuclear facilities or mines is normally considered
(a) 2 mSv per week (b) 3 mSv per week

(c) 4 mSv per week (d) 1 mSv per week

201. For the treatment of skin diseases
(a) α-radiations are used (b) β-radiations are used
(c) γ-radiations are used (d) All of these

202. Which of the following is a better shield against γ-rays?
(a) heavy water (b) lead
(c) ordinary water (d) aluminium

203. Phosphorus-32 or strontium-90 are used for the treatment of
(a) blood cancer (b) bone cancer
(c) skin cancer (d) all of these

204. The unit of radioactivity "curie" is equal to
(a) 3.7×10^{7} disintegration per second
(b) 3.7×10^{8} disintegration per second
(c) 3.7×10^{9} disintegration per second
(d) 3.7×10^{10} disintegration per second

205. Various types of cancer are treated by:
(a) cobalt-60 (b) strontium-90
(c) carbon-14 (d) nickel-63

206. One gray (Gy) is equal to
(a) 3.7×10^{10} J/kg (b) 1.6×10^{-19} J/kg
(c) 1 J/kg (d) none of these

207. The background radiation to which we are exposed on the average is
(a) 2 Sv per year (b) 2 mSv per year
(c) 20 mSv per year (d) 0.01 Sv

208. An old unit, the rem is equal to
(a) 0.1 Sv (b) 0.001 Sv
(c) 0.01 Sv (d) 1.0 Sv

209. The relation between rad and Gy is
(a) 1 rad = 0.1 Gy (b) 1 rad = 0.01 Gy
(c) 1 rad = 0.001 Gy (d) 1 rad = 1.0 Gy

210. The SI unit of equivalent dose is Sievert (Sv) and
(a) 1 Sv = 1 Gy ÷ RBE (b) 1 Sv = 1 Gy – RBE
(c) $1\text{ Sv} = \frac{1\text{ Gy}}{\text{RBE}}$ (d) 1 Sv = 1 Gy × RBE

Basic Forces Of Nature, Building Blocks Of Matter

211. The number of basic forces present in nature are
(a) 1 (b) 7

(c) 9 (d) 5

212. Electric and magnetic forces were unified by:
(a) Maxwell (b) Faraday
(c) Faraday and Maxwell (d) None of these

213. Fundamental forces of nature are
(a) weak nuclear force
(b) strong nuclear force
(c) electromagnetic force and weak nuclear force
(d) all of these

214. Electromagnetic force is
(a) long range (b) short range
(c) medium range (d) none of these

215. Weak nuclear force is
(a) long range (b) short range
(c) medium range (d) none of these

216. Electromagnetic and weak forces were unified by
(a) Weinberg (b) Glashow
(c) Abdul Salam (d) all of these

217. Dr. Abdul Salam was awarded noble prize in
(a) 1969 (b) 1979
(c) 1985 (d) 1989

218. After present unification, the number of fundamental forces are
(a) 2 (b) 4
(c) 3 (d) 5

219. Subatomic particles are divided into
(a) two groups (b) three groups
(c) four groups (d) five groups

220. Subatomic particles are divided into
(a) photons (b) leptons
(c) hardens (d) all of these

221. The particles equal in mass or greater than protons are called
(a) baryons (b) leptons
(c) quarks (d) mesons

222. The particles lighter than protons are called
(a) leptons (b) baryons
(c) mesons (d) quarks

223. Leptons are

(a) electrons (b) neutrons
(c) muons (d) all of these

224. A pair of quark and anti-quark make a
(a) meson (b) hardon
(c) lepton (d) baryons

225. Three quarks make a
(a) baryon (b) hardon
(c) lepton (d) meson

226. The building blocks of protons and neutrons are called
(a) positrons (b) neon
(c) electrons (d) quarks

227. The types of quarks are
(a) 2 (b) 3
(c) 4 (d) 6

228. Quarks carry
(a) no charge no spin (b) charge as well as spin
(c) no charge (d) no mass

229. At least three quarks are necessary to form a
(a) proton only (b) neutrons only
(c) both protons and neutrons (d) all of these

230. Which one of the following belongs to hadrons group?
(a) neutrons (b) protons
(c) mesons (d) all of these

231. Which one of the following belongs to leptons group?
(a) electrons (b) neutrons
(c) muons (d) all of these

232. With two up quarks and one down quark, which of the following can be made?
(a) proton (b) neutron
(c) electron (d) photon

233. With one up quark and two down quarks, which of the following can be made?
(a) proton (b) neutron
(c) electron (d) photon

Answer Key's

1.	(b) nuclear physics	2.	(d) nucleus
3.	(c) Rutherford	4.	(c) 1920
5.	(a) Chadwick	6.	(b) 1932
7.	(d) 9%	8.	(b) 1.67×10^{-27} kg
9.	(a) 1.6×10^{-19} C	10.	(b) 1.67×10^{-27} kg
11.	(b) -1.6×10^{-19} C	12.	(d) J. J. Thomson
13.	(c) 10^{-27} kg	14.	(b) 10^{-27} kg
15.	(b) 10^{-10} m	16.	(d) 10^{-14} m
17.	(c) proton and neutron	18.	(c) positron
19.	(b) 1.66×10^{-27} kg	20.	(d) 931 MeV
21.	(a) Ze	22.	(b) N > Z
23.	(c) 36	24.	(c) both of above
25.	(a) mass number	26.	(b) electrons
27.	(c) N = A – Z	28.	(c) 143
29.	(a) Rutherford	30.	(b) Atomic number
31.	(b)Isotopes	32.	(c) 3
33.	(d) all of these	34.	(c) No neutron
35.	(c) Protium	36.	(a)Deuterium
37.	(d) Tritium	38.	(a) same
39.	(a) Electrons	40.	(c) atomic number
41.	(d) 36	42.	(d) all of these
43.	(a) 2	44.	(a) Isotopes
45.	(a) B^2	46.	(a) Neon-20
47.	(d) 20, 21, 22	48.	(c) mass defect
49.	(d) all of these	50.	(b) 143
51.	(b) binding energy	52.	(d) mass defect
53.	(a) 1/12 of ^{12}C	54.	(d) both a and b
55.	(b) greater	56.	(d) greater for medium weight nuclei

57.	(b) 12 u	58.	(c) netron, proton
59.	(d) Henry Becquerel	60.	(a) 1896
61.	(c) daughter nucleus has two protons less than parent nucleus	62.	(c) Iron
63.	(b) polonium and radium	64.	(b) nucleu
65.	(d) $^{1}_{0}n \rightarrow {}^{1}_{1}H + {}^{0}_{-1}e$	66.	(a)spontaneously
67.	(d) helium nuclei	68.	(a) electrons
69.	(c) photons	70.	(c) $Z > 82$
71.	(a) Becquerel	72.	(d) radioactivity
73.	(d) 4	74.	(a) –e
75.	(a) no charge	76.	(d) decreases exponentially with time
77.	(b) decreases exponentially with time	78.	(a) 1
79.	(d) 75%	80.	(b) half life
81.	(b) $T_{1/2} = 0.693/\lambda$	82.	(c) decay constant
83.	(c) S^{-1}	84.	(b) 0.693
85.	(c) amount of radioactive substance	86.	(a) different half lives
87.	(a) disintegration decay	88.	(b) decay element
89.	(d) both a and c	90.	(a) ¼ N_o
91.	(d) both a and c	92.	(b) 75%
93.	(a) ^{235}U	94.	(a) parent element
95.	(c) 2 netron	96.	(d) uranium – 239
97.	(c) range of particle	98.	(d) all of these
99.	(b) 7000	100.	(a) ionization
101.	(c) 100 times	102.	(c) greater than α-particle
103.	(b) electromagnetic waves	104.	(d) γ-rays
105.	(b) greater than 1.02 MeV	106.	(a) less than 0.5 MeV
107.	(a) electrons	108.	(c) greater than β–particle
109.	(d) less than α-particle	110.	(c) γ- rays
111.	(d) all of these	112.	(d)
113.	(a) $I = I_0 e^{-\mu x}$	114.	(d) all of these

115.	(d) radiation detector	116.	(d) all of these
117.	(d) all of these	118.	(d) C.T.R. Wilson
119.	(c) ions and dust particles	120.	(c) supersaturated vapours
121.	(d) all of these	122.	(d) all of these
123.	(a) irregular	124.	(c) electrons
125.	(b) fast counting	126.	(b) positively charged
127.	(b) anode	128.	(d) non-conducting
129.	(d) neon and bromine	130.	(d) fast counting
131.	(d) 400 V	132.	(a) 1 μs
133.	(d) 10^{-4} s	134.	(b) 1 kv
135.	(c) greater then	136.	(b) reverse bias
137.	(c) γ- rays	138.	(d) all of these
139.	(a) silicon diode	140.	(c) 3 eV – 4 eV
141.	(b) solid state detector	142.	(c)both charge and mass
143.	(c) strass mass and Otto Hahn	144.	(b) always produces the same fragments
145.	(a) core	146.	(b) cadmium rods
147.	(a) fission	148.	(c) fission
149.	(b) 200 MeV	150.	(c) Heavy water
151.	(d) slow down the neutron to thermal energies	152.	(a) Low energy
153.	(a) K.E. of fragments	154.	(b) the critical mass
155.	(c) 0.9 MeV	156.	(b)3
157.	(c) 9×10^{9} J	158.	(c) $^{238}_{92}U$
159.	(d) no moderator	160.	(c) $^{238}_{92}PU$
161.	(a) nuclear bomb	162.	(a) $^{1}_{1}H$
163.	(b) 9	164.	(a) $^{238}_{92}U$
165.	(b) 7.7 MeV	166.	(c) mass in the nucleus
167.	(b) moderator	168.	(b) less than the masses of reactant

			nuclei
169.	(b) pressurize water reactor	170.	(a) 1 MeV
171.	(b) fusion reaction	172.	(b)fusion reaction
173.	(b) 24 MeV	174.	(b) fusion reaction
175.	(a) proton	176.	(d) 6.4 MeV
177.	(b) fusion	178.	(d) all of these
179.	(b) 10^7 °C	180.	(b) radon
181.	(c) iodine-131	182.	(b) carbon – 14
183.	(d) cobalt – 60	184.	(d) thyroid gland
185.	(b) α-particles	186.	(b) cobalt – 60
187.	(d) X-rays	188.	(d) all of these
189.	(d) high energy charged particles and electromagnetic radiation	190.	(d) all of these
191.	(c) γ-rays	192.	(b) radio iodine
193.	(c) γ-radiation	194.	(d) all of these
195.	(a) nuclear facilities	196.	(a) gray
197.	(b) gray	198.	(a) Becquerel
199.	(a) $D = \frac{E}{m}$	200.	(d) 1 mSv per week
201.	(c) γ–radiations are used	202.	(b) lead
203.	(c) skin cancer	204.	(d) 3.7×10^{10} disintegration per second
205.	(a) cobalt-60	206.	(c) 1 J/kg
207.	(b) 2 mSv per year	208.	(c) 0.01 Sv
209.	(b) 1 rad = 0.01 Gy	210.	(d) 1 Sv = 1 Gy × RBE
211.	(d) 5	212.	(c) Faraday and Maxwell
213.	(d) all of these	214.	(a) long range
215.	(b) short range	216.	(d) all of these
217.	(b) 1979	218.	(c) 3
219.	(b) three groups	220.	(d) all of these
221.	(a) baryons	222.	(c) mesons

223.	(d) all of these	224.	(a) meson
225.	(a) baryon	226.	(d) quarks
227.	(d) 6	228.	(b) charge as well as spin
229.	(c) both protons and neutrons	230.	(d) all of these
231.	(d) all of these	232.	(a) proton
233.	(b) neutron		

Brain Teasing MCQ's (with Hints)

◊ Four possible answers to each statement are given below. Tick (✓) the correct answer:

1. Which of the following particles can be added to the nucleus of an atom without changing its chemical properties?
   (a) neutron (b) proton
   (c) electron (d) α – particles
2. Which of the following is the approximate density of nuclear matter (nucleus)
   (a) 10^3 Kg/m^3 (b) 10^7 Kg/m^3
   (c) 10^{10} Kg/m^3 (d) 10^{17} Kg/m^3
3. For atomic nuclei, the binding energy per nucleon
   (a) increases continuously with increase in mass number
   (b) decreases continuously with increase in mass number
   (c) remains constant with increase in mass number
   (d) first increase and then decreases with increase in mass number
4. If M is mass of nucleus and A is the mass number then $\frac{M-A}{M}$ is called its
   (a) binding energy (b) Fermi energy
   (c) Packing fraction (d) mass defect
5. Which one of the following rays can pass through 20cm thickness of steel?
   (a) α – rays (b) β – rays
   (c) γ – rays (d) ultraviolet rays

6. α, β and α – rays emitted by a radioactive substance are passed through a region at right angle to their path. The energy gained will be
   (a) maximum for α – rays (b) maximum for β – rays
   (c) maximum for γ – rays (d) zero for all of them

7. One – eighth of the initial mass of a certain radioactive isotope remain undecayed after one hour. Which of the following is the half life of isotope in minutes?
   (a) 8min (b) 20min
   (c) 30min (d) 45min

8. $_{92}U^{238}$ nucleus emits two α – particles and two β – particles and transforms into a thorium nucleus. Which of the following is the mass number and atomic number of the thorium nucleus so produced?
   (a) 230, 90 (b) 230, 88
   (c) 234, 90 (d) 234, 88

9. A radioactive substance has a half life of 4 months . Three – fourth of the substance will decays in
   (a) 6 months (b) 8 months
   (c) 12 months (d) 16 months

10. The probability of a radioactive atom to survive 5 times longer than its half period is
   (a) $\frac{2}{5}$ (b) $(2)^5$
   (c) $(2)^{-5}$ (d) $(5)^2$

11. A radioactive isotope X with half life of 1.37×10^9 years decays to Y which is stable. A sample of rocks from the moon was found to contain both X and Y in the ratio of 1:7. Which of the following is the age of rocks?
   (a) 1.96×10^9 years (b) 4.11×10^9 years
   (c) 3.85×10^9 years (d) 9.59×10^9 years

12. Which of the following is the percentage of the original quantity of a radioactive material left after five half – lives approximately
   (a) 3% (b) 5%
   (c) 10% (d) 20%

13. The half life of a radioactive element which has only $\frac{1}{32}$ of its original mass left after a lapse of 60 days is

   (a) 30 days (b) 20 days
   (c) 15 days (d) 12 days

14. Consider α – particles, β – particles and r – rays each having an energy of 0.5Mev. In increasing order of penetrating powers, The radiations are
   (a) α,β,r (b) α,r,β
   (c) β,r,α (d) r,β,α

15. Which of the following is the pair of isobars?
   (a) $_1H^1$ and $_1H^2$ (b) $_1H^2$ and $_1H^3$
   (c) $_6C^{12}$ and $_6C^{13}$ (d) $_{15}P^{30}$ and $_{14}Si^{30}$

16. Which of the following is a good nuclear fuel?
   (a) Neptunium –239 (b) Plutonium –239
   (c) Thorium –236 (d) Uranium –236

17. Which of the following is energy equivalent to one microgram (1μgm)?
   (a) 9×10^7 J (b) 9×10^{10} J
   (c) 9×10^7 erg (d) 9×10^{10} erg

18. The reciprocal of the decay constant of a radioactive substance is known as
   (a) total life (b) mean life
   (c) half life (d) none of the above

19. Enriched uranium is better as a fuel for a nuclear reactor because it has greater proportion of
   (a) U^{233} (b) U^{235}
   (c) U^{238} (d) U^{239}

20. In a nuclear reactor, cadmium rods are used to
   (a) produce neutron (b) speed up neutrons
   (c) slow down neutron (d) absorb neutrons

21. Fusion reaction takes place at high temperature because
   (a) atoms are ionized at high temperature
   (b) kinetic energy is high enough to overcome repulsion at high temperature
   (c) molecules break up at high temperature
   (d) nuclei break up at high temperature

22. What was the fissionable material used in the atomic bomb droped at Nagasaki (Japan) in the year 1945?
   (a) uranium (b) thorium
   (c) neptunium (d) plutonium

23. If F_{pp}, P_{nn} and P_{pn} denotes, respectively the nuclear forces between two protons, between two neutrons and between proton and neutron then
(a) $F_{pp} = F_{nn} = F_{pn}$ (b) $F_{pp} \neq F_{nn} \neq F_{pn}$
(c) $F_{pp} = F_{nn} \neq F_{pn}$ (d) $F_{pp} \neq F_{nn} = F_{pn}$

24. Which of the following is used as a moderator in nuclear reactor?
(a) uranium (b) cadmium
(c) heavy water (d) Boron

25. A neutron decays into a proton, an electron and ______?
(a) an antineutrino (b) a neutrino
(c) an α – particle (d) None of these

26. In nuclear reaction, there is conservation of
(a) mass only (b) momentum only
(c) energy only (d) mass – energy and momentum

27. Complete the equation for following fission process:
$_{92}U^{235} + {_0n^1} \longrightarrow {_{38}Sr^{90}} + \ldots\ldots\ldots$
(a) $_{54}Xe^{143} + 3\,{_0n^1}$ (b) $_{54}Xe^{145}$
(c) $_{54}Xe^{142} + 3\,{_0n^1}$ (d) $_{57}Xe^{142}$

28. Nuclear forces are mediated by
(a) neutron (b) meson
(c) electron (d) proton

29. Nuclear forces are
(a) long range (b) charge dependent
(c) spin dependent (d) equal in strength to electromagnetic forces

30. Which of the following particle is unstable out side the atom?
(a) proton (b) electron
(c) photon (d) neutron

31. It is possible to understand nuclear fission on the basis of the
(a) liquid drop model of the nucleus (b) meson theory of the nuclear forces
(c) proton – proton cycle (d) all of above

32. In a nuclear reactor using $_{92}U^{235}$ as fuel, the power output is 4.8MW. Which of the following is the number of fission per second? (energy released in one fission of $_{92}U^{235}$ = 200Mev)
(a) 2.4×10^{12} (b) 1.5×10^{17}
(c) 3×10^{19} (d) 1.5×10^{25}

33. In a nuclear reaction
$$_ZX^A + {_2He^4} \longrightarrow {_{Z+2}Y^{A+3}} + W$$
What particle does w denote?
(a) electron (b) proton
(c) neutron (d) positron

34. Nuclear fusion is the source of energy in
(a) Sun and atomic bomb (b) nuclear reactor and sun
(c) nuclear reactor and atomic bomb (d) Sun and hydrogen bomb

35. In which radioactive disintegration neutron dissociates into proton and electron?
(a) α – emission (b) β – emission
(c) γ – emission (d) None of these

36. If the half life of a radioactive substance is T, then its decay constant λ is given by
(a) $\lambda T = 1$ (b) $\lambda T = \frac{1}{2}$
(c) $\lambda T = \log_e 2$ (d) $\lambda = -\log_e 2T$

37. The constituents of nucleus are held together by
(a) electromagnetic force (b) gravitational force
(c) strong force (d) weak nuclear force

38. Of the three basic gravitational, electrostatic and nuclear forces, which two are able to provide an attractive force between two neutrons?
(a) electrostatic and nuclear (b) gravitational and nuclear
(c) gravitational and electrostatic (d) All of the above

39. With emission of β – particle from the nucleus, the ratio of neutron to proton.
(a) decreases (b) increases
(c) remain same (d) None of the above

40. The average life of the radioactive substance is
(a) equal to its half life (b) greater than its half life
(c) less than its half life
(d) sometimes less and sometimes equal to its half life

41. The ionization energy of an atom compared to the binding energy of a nucleus is
(a) less (b) more
(c) equal (d) sometimes less and sometimes more

Answer with Hints

No.	Correct Option	Answers	Hint
1	a	netron	
2	d	$10^{17}\frac{Kg}{m^3}$	
3	d	first increases and then decreases with increase in mass number	
4	c	packing fraction	
5	c	$\gamma-$rays	
6	d	zero for all of them	
7	b	(20 min)	$\frac{1}{8}=\left(\frac{1}{2}\right)^3 \Rightarrow n=3$ $T_{\frac{1}{2}}=\frac{t}{n}$ $T_{\frac{1}{2}}=\frac{60\,min}{3}$ $T_{\frac{1}{2}}=20min$
8	d	$\frac{1}{16}$	No of half lives $=\frac{6400}{1600}$ $n=4$ fraction remain undecayed $=\left(\frac{1}{2}\right)^n$ $=\left(\frac{1}{2}\right)^4$ $=\frac{1}{16}$
9	b	8 months	
10	c	$(2)^{-5}$	
11	c	(4.11×10^9 year)	fraction of X undercayed $=\frac{1}{8}$ $=\left(\frac{1}{2}\right)^3$ $n=3$ $t=3T_{\frac{1}{2}}=3\times1.37\times10^9$ $t=4.11\times10^9$ year
12	a	(3%)	fraction undecayed after 5 half lives $=\left(\frac{1}{2}\right)^5$ $=\frac{1}{32}$ $\%=\frac{1}{32}\times100$ $=3\%$
13	d	12 days	
14	a	α,β,γ	
15	d	$_{15}P^{30}$ and $_{14}Si^{30}$	
16	b	Plutonium –239	
17	a	$9\times10^7 J$	Formula $E=mc^2$
18	c	mean life	$T^*=\frac{1}{\lambda}$
19	b	U^{235}	
20	d	Absorb neutrons	
21	b	K.E is high enough to over come repulsion at high temperature	
22	d	plutonium	
23	a	$F_{pp}=F_{nn}=F_{pn}$	

24	c	heavy water	
25	a	an antineutrino	
26	d	mass, energy and momentum	
27	a	${}_{54}Xe^{143} + {}_{30}n^{1}$	
28	b	meson	
29	c	spin dependent	
30	d	neutron	
31	a	liquid drop model of the nucleus	
32	b	(1.5×10^{17})	Total energy released in 1 sec = 4.8×10^{6}J Energy released in one fission = 200 Mev $= 200 \times 10^{6} \times 1.6 \times 10^{-19}$J No of fission per sec = $\dfrac{4.8 \times 10^{6}}{200 \times 1.6 \times 10^{-13}}$ $= 1.5 \times 10^{17}$
33	c	neuron	
34	d	sun and hydrogen bomb	
35	b	β – emission	
36	c	$\lambda T = \log_e 2$	
37	d	Weak nuclear force	
38	b	gravitational and nuclear	
39	a	decrease	
40	b	greater than its half life	
41	a	less	

Additional Short Questions

1. What is atomic mass unit (a.m.u) and show that

$$1u = 1.6606 \times 10^{-27}\ \text{Kg}$$

Ans. Atomic mass unit is the unit of mass used in nuclear physics as adopted by the international union of pure and Applied Physics (IUPAP).

One amu is equal to $\left(\frac{1}{12}\right)$th of the mass of one ${}_{6}C^{12}$ atom

$$\text{Mass of one carbon atom} = \frac{12\text{gm}}{6.023 \times 10^{23}}$$

$$\text{Mass of one carbon atom} = \frac{12 \times 10^{-3}\ \text{Kg}}{6.023 \times 10^{23}}$$

$$1\text{amu} = \frac{1}{12}(\text{mass of one carbon atom})$$

$$= \frac{1}{12}\left(\frac{12 \times 10^{-3}\ \text{Kg}}{6.023 \times 10^{23}}\right)$$

$$= \frac{1}{12}(1.992678 \times 10^{-26}\ \text{Kg})$$

$$1\text{amu} = 1U = 1.6606 \times 10^{-27}\ \text{Kg}$$

2. Show that 1u = 931MeV (approximately)

Ans.

$$1u = 1.660565 \times 10^{-27}\ \text{kg}$$

$$E = mc^2$$

$$\text{Energy of } 1u = 1.660565 \times 10^{-27}(2.998 \times 10^{8})^2$$

$$= 1.4925 \times 10^{-10}\ \text{J}$$

$$1u = \frac{1.4925 \times 10^{-10}}{1.602 \times 10^{-19}}$$

$$1u = 931.64 \times 10^{6}\text{eV}$$

$$1u = 931\ \text{MeV (approximately)}$$

3. What is mass defect?

Ans. The mass of nucleus is always less than total mass of protons and neutrons (i.e nucleons) that make up the nucleus.

The difference of mass of nucleon and mass of nucleus is called mass defect.

The missing mass is converted into energy and is called binding energy.

4. **What are the drawback of a Geiger counter as a radiation detector?**

Ans. It is not suitable for fast counting of the radiations, it is due to its long dead time (10^{-4} sec), some of the radiations remains unaccounted during long dead time.

5. **The number of neutrons is more than the number of protons is heavy nuclei why?**

Ans. When number of protons become very large, the long range electrostatic force of repulsion will also be greater. For nuclear stability the short range nuclear force which is attractive must dominate. For this the number of neutrons must be more than that of number of protons.

6. **Will a single nucleus emit α–particle, β–particle and γ–rays together?**

Ans. No, one nucleus can emit either α–particle or β–particle at one time.

7. **Why do we call the electrons emitted during radioactivity as β–particle?**

Ans. We call the electrons emitted during radioactivity as β–particle to show that he electron is coming out from the nucleus.

8. **In general, an α–emission or β–emission is followed by emission of γ–rays. Why?**

Ans. After emission of α or β–particle the nucleus become a new element and it remain in excited state. When the atom makes a transition from excited state to ground state a γ–ray photon is emitted.

9. **Explain whether the neutron–proton ratio increase or decrease during Beta decay.**

Ans. During beta decay the neutron number decreases by one and number of proton increases by one. Therefore the ratio of neutron to proton decreases.

10. **Is there any difference between β–particle and electrons emitted by photoelectric emission and thermionic emission?**

Ans. Yes, in photoelectric emission and thermionic emission orbital electrons are emitted and K.E is low.

In the case of radioactivity, the electrons are emitted from the nucleus. During the process of β – decay the β – particle travel with high velocity and high K.E.

11. **What is meant by nuclear physics?**

Ans. The branch of physics that is concerned with nuclear structure, properties and reactions and their applications (e.g. in producing nuclear power or using radioisotopes) is called nuclear physics.

12. **What are isotopes? Give an example**

Ans. Nuclei of the same element which have the same atomic number (Z) but different mass number (A) are called isotopes.

The chemical properties of all the isotopes of an element are same, as chemical properties depend on the number of electrons.

As physical properties of all the isotopes of an element are not same, so we use physical methods to separate isotopes.

For example, Hydrogen has three isotopes

(i) $^{1}_{1}H$ (ii) $^{2}_{1}H$ (iii) $^{3}_{1}H$

(Lhr 2004, Mtn 2006, Fsd 2006, Mir Pur 2007)

13. **What is mass spectrograph? What is the principle of its working?**

Ans. A device which is used to separate the isotopes of an element and also to determine their masses very accurately is called mass spectrograph.

Its working is based upon the principle of electric and magnetic fields to sort out atoms according to their masses or to detect different isotopes of an element.

14. **Define the terms mass defect and binding energy?**

Ans. **Mass defect:** The difference between the run of masses of individual nucleons and they mass of the nucleus is called the mass defect.

Binding energy: The energy required to break the nucleus into its nucleons (i.e. neutrons and protons) is called binding energy. (Grw 2005, Lhr 2008)

15. **Why are heavy nuclei unstable?**

Ans. As the nuclear force between nucleons is stronger than the Coulomb's repulsive force between the protons. In case of smaller nuclei, the distance between the protons is small and strong nuclear force is more dominant. However with the protons is small and strong nuclear force is more dominant. However with the addition of more nuclei, the distance between the protons increases and as strong nuclear force is short range, it becomes weaker and coulomb"s repulsive force become dominate and nucleus becomes unstable.

16. **Define radioactivity and radioactive elements?**

Ans. The elements having charge number Z greater than 82 (Z > 82) are unstable. They emit invisible radiation (i.e. α, β, and γ) which effect the photographic plate. Such elements are called radioactive elements and this process is called radioactivity.

17. **Do the laws of conservation of energy, momentum and charge remain applicable during a nuclear reaction?**

Ans. Yes, the laws of conservation of energy, momentum and charge remain applicable during a nuclear reaction.

18. **Can we separate isotopes of an element by chemical method?**

Ans. The isotopes of an element cannot be separated by chemical methods, because the chemical properties of all isotopes of an element are alike. So physical methods are used to separate isotopes.

19. **Discuss the nature of alpha, beta and gamma radiations?**

Ans. (i) **Alpha Particles:** α-particles are similar to helium nucleus. It contains two neutrons and two protons. Their charge number is 2 and mass number is 4.

(ii) **Beta-particles:** β-particles are fast moving electrons coming out of nucleus. They usually have less energy than α-particles.

(iii) **Gamma radiations:** γ-radiations like X-rays are electromagnetic radiation coming out of the nucleus of radioactive element. They have very high frequency.

20. **What is meant by half life?**

Ans. The time taken by the atoms of a radioactive element to decay to half the original number is called half life of the radioactive element. It is denoted by $T_{1/2}$

$$T_{1/2} = \frac{0.693}{\lambda}$$ where λ is called the decay constant. (Lhr 2005, Grw 2008)

21. **Define radioactive decay constant and what is its unit?**

Ans. Radioactive decay constant can be defined as the fraction of decaying atoms per unit time.

Mathematically, $\lambda = \dfrac{\Delta N/N}{\Delta t}$

Its unit is sec^{-1}.

22. **What is the difference between natural and artificial radioactivity?**

Ans. **Natural Radioactivity:** The process of emitting radiations randomly and spontaneously is called natural radioactivity.

Artificial Radioactivity: Radioactivity induced by bombarding stable nuclei with high energy particles is called artificial Radioactivity.

23. **What is meant by fluorescence?**

Ans. Fluorescence is property of absorbing radiant energy of high frequency and re-emitting energy of low frequency in the visible region of electromagnetic spectrum.

24. **What is difference between an electron and β-particle?**

Ans. An electron is a negatively charged particle which revolves in an orbit around the nucleus of an atom, where as β-particle is also negatively charged particle which is emitted from the nucleus of an atom with very high speed.

25. **What is the difference between radiation detector and counter?**

Ans. **Radiation detectors:** Such devices used to indicate the presence of fast moving charged atomic or nuclear particles by observation of electrical disturbance created by a particles as it passed through the device are known as radiation detectors.

Radiation counter: Such devices used to counting particles and photons are called radiation counter. e.g. Geiger Muller counter.

26. **Write down the principle of Wilson cloud chamber?**

Ans. It is based upon the principle that supersaturated vapours condense more readily on ions.

27. **Discuss the term dead time for GM counter.**

Ans. The positive ions take several hundred times as long to reach the outer cathode, because positive ions are very massive than the electrons. During this time further incoming particles cannot be counted. This time is called the dead time (10^{-4}s) of the counter.

28. **What is self-quenching?**

Ans. The quenching gas has ionization potential less than that of principal gas. Thus, the ions of quenching gas reach cathode before the ions of principal gas. When ions of quenching gas reach near cathode, they capture electrons and become neutral molecules. In process of neutralization of quenching gas molecules, the excess energy of quenching molecules is dissipated in dissociation of the molecules rather than in the release of electrons from the cathode. The gas quenching is called self-quenching.

29. **What are advantages of solid state detector over the GM counter?**

Ans. (i) Solid state detector can count very fast as compared to GM counter.

(ii) Solid state detector is very small in size and operates at low voltage.

(iii) Solid state detector is more efficient and accurate.

30. **What is the amount of energy needed in solid state detector to produce the electron hole pair to make it useful and compare it with gas filled counters?**

Ans. The energy required to produce electron-hole pair is about 3eV to 4eV which makes the device useful for detecting low energy particles.

31. **What is chain reaction?**

Ans. We know that when ${}^{235}_{92}U$ absorbs a neutron, it break into two nuclei almost of equal masses alongwith two or three neutrons and release of energy. This fission reaction can be maintained continuously by proper use of the neutrons emitted during fission reaction of ${}^{235}_{92}U$. Such a process is called fission chain reaction. (Lhr 2004)

32. How can the fast moving neutrons be stopped?

Ans. As when an object of certain mass collides with another object of equal mass at rest, then as a result of elastic collision, the moving object comes to rest and stationary object begins to move with the velocity of colliding object. e.g. when neutrons were passed through a block of paraffin, fast moving protons were ejected and neutrons were stopped.

33. What is the difference between fission and fusion reaction?

Ans. **Fission reaction:** A reaction in which a heavy nucleus, like that of Uranium splits up into two nuclei of equal size along with the emission of energy during the reaction is called fission reaction.

Fusion reaction: A reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction.

In fusion reaction more energy is liberated as per nucleon as compared to the fission reaction.

34. What is meant by critical mass and critical volume?

Ans. The mass of the element, for example uranium, in which one neutron out of all neutrons produced in one fission reaction, produces further fission is called the critical mass. The volume of this mass of material is called critical volume.

35. What is meant by enrichment of uranium?

Ans. Enriched uranium is one in which the percentage of ${}^{235}_{92}U$ is greater than its percentage in natural uranium. This term is also applied to the addition of the fissile nuclide ${}^{239}_{94}U$ to uranium for the same purpose.

36. What is role of moderator in the nuclear reactor?

Ans. The role of moderator in the nuclear reactor is to slow down the speed of fast neutrons, produced during fission process.

37. What we use the neutron absorber in the nuclear reactor?

Ans. We use cadmium rods or boron for absorbing neutrons in the nuclear reactor. These control rods are moved in or out of the reactor core to control neutrons that can initiate further fission. In this way speed of the chain reaction is kept under control.

38. Name any power plant in PAKISTAN to generate the electricity by nuclear fuel?

Ans. Karachi Nuclear Power Plant (KANUPP) is generating electricity by nuclear fuel.

39. What is the most suitable way securing the environment from the radioactive pollution from radioactive waste of the reactor?

Ans. The most suitable way for securing the environment from the radioactive pollution from radioactive waste of the reactor is to preserve it in the bottom of old salt mines, which are thousands of meters below the surface of the earth.

40. What are the uses of Nuclear reactors?

Ans. Nuclear reactors are used for the following purpose:

(i) Research

(ii) Production of plutonium which is used in atomic bombs.

(iii) For the production of atomic energy for industrial and peaceful purposes.

41. What is temperature requirement to start the nuclear fusion?

Ans. The temperature requirement to start the nuclear fusion reaction is about 10 million degrees Celsius. At such extraordinarily high temperature the reaction that takes place is called thermo nuclear reaction.

42. Give some examples of thermo nuclear fusion reaction

Ans. (i) Hydrogen bomb is an example of fusion reaction.

(ii) The source of energy on the sun is also due to fusion reaction. During this process two hydrogen nuclei or two protons fuse to form deuteron.

43. Why the radiation level of our environment is continuously increasing?

Ans. Radiation level of our environment is continuously increasing due to depletion of ozone layer, aerosol spray, plastic foam industry, use of chloroflouro carbons, diagnostic X-rays, medical practices.

44. What are cosmic rays?

Ans. Cosmic rays are radiation consisting of high energy charged particles and electromagnetic radiation.

Cosmic rays are coming to us from outer space and partly from naturally radioactive substances in the earth's crust.

45. What do you mean by radiography?

Ans. The technique of producing a photographic image of an opaque specimen by transmitting a beam of X-rays or γ-rays through it onto an adjacent photographic film is known as radiography.

46. Define the units of radioactive decay

Ans. The units of radioactive decay are given below:

(i) Becquerel (Bq): One Becquerel is equal to one disintegration per second.

1 Bq = 1 disintegration/sec.

(ii) Curie (Ci): Curie is a bigger unit and

1 curie = 3.7×10^{10} disintegration/sec.

47. What do you mean by absorbed dose and equivalent dose?

Ans. **Absorbed dose (D):** It is defined as the Energy E absorbed from an ionizing radiation per unit mass 'm' of the absorbing body i.e.

$$D = \frac{E}{m}$$

SI unit of absorbed dose is gray Gy

Equivalent dose (De): It is defined as the product of absorbed dose and RBE of the kind of radiation being absorbed.

$$D_e = D \times RBE$$

SI unit of equivalent dose is Sievert (Sv) and

$$1\ Sv = Gy \times RBE$$

An old unit of equivalent dose is rem, where,

$$1\ rem = 0.01\ sv$$

48. What are basic forces of nature?

Ans. There were five basic forces of nature:

(i) Gravitational force
(ii) Magnetic force
(iii) Electric force
(iv) Weak nuclear force
(v) The strong force **(Rwp 2007)**

Now two forces are unfired, and there are three basic forces.

1- Gravitational force 2- Electro weak force
3- Strong nuclear force

49. For what Abdul Salam was awarded with noble prize?

Ans. Dr. Abdul Salam and his colleagues Glashow and Wienberg were awarded Nobel Prize in 1979 due to presenting unified theory. They unified electromagnetic force and weak nuclear force as a single force called "Electro Weak Force".

50. What do you mean by elementary particles?

Ans. The particles which are the basic building blocks of matter are called elementary particles.

e.g. All photons and leptons are elementary particles.

51. Differentiate between Hardons and Leptons

Ans. Hardons: These are not elementary particles. They are composed of other elementary particles called quarks. The examples of hardons are protons, neutrons, mesons, etc. They experience strong nuclear force.

Leptons: Leptons are elementary particles. They do not experience strong nuclear force.

Electron, muons and neutrinos are leptons.

52. Differentiate between Baryons and Mesons.

Ans. Baryons: The particles having mass equal or greater than protons are called baryons.

Masons: The particles having mass less than protons are called mesons.

Some Important MCQ's

(Past papers Multiple Choice Questions)

Note: Write answer to the question on the objective answer sheet provided. You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the circle in front of that question number. Use marker or pen to fill circles. Cutting or filling of two or more circles will result in zero mark in that question. Attempt as many question as given in objective type question paper and leave other blank.

Q. NO. 1: Fill the correct circle like A, B, C or D to the following questions.

1. When a-particle is emitted from any nucleus, its mass number _____ and its charge number _____
(a) Increases by 2, increases by 2 (b) Decreases by 4, increases by 2
(c) Decreases by 4, decreases by 2 (d) Decreases by 4, decreases by 4

2. A sample contains N radioactive nuclei. After 4 half lives number of nuclei decayed is _______
(a) $\frac{N}{16}$ (b) $\frac{15N}{16}$ (c) $\frac{N}{8}$ (d) $\frac{7N}{8}$

3. Neutron was discovered in 1932 by:
(a) Bohr (b) Chadwick (c) Dirac (d) Fermi

4. Types of quarks are:
(a) 4 (b) 6 (c) 8 (d) 10

5. By emitting beta-particle and gamma-particle simultaneously the nucleus changes its charge by:
(a) Losses by 1 (b) Increases by 1 (c) Increases by 2 (d) No change will be observed

6. Which of the following are elementary particles:
(a) Protons (b) Neutrons (c) Photons (d) Mesons

7. In nuclear fission reaction, when the products are Xe and Sr, the number of neutrons emitted are
(a) 4 (b) 3 (c) 2 (d) 1

8. Energy given out per nuclean in p-p reaction is
(a) 5.2MeV (b) 6 MeV (c) 6.4 MeV (d) 7.7 MeV

9. Neutron was discovered in 1932 by
(a) Bohr (b) Chadwick (c) Dirac (d) Fermi

10. Sub-atomic particles are divided into
(a) photons (b) leptons (c) hadrons (d) all of these

11. A pair of quark and anti-quark makes a
(a) meson (b) baryon (c) photon (d) proton

12. Abd-us-Salam forwarded theory of unification of
(a) electromagnetic and weak forces
(b) electromagnetic and strong nuclear forces
(c) electromagnetic and gravitational forces
(d) electric and magnetic forces

13. The building blocks of protons and neutrons are called
(a) ions (b) electrons (c) positrons (d) quarks

14. A detector which can count fast and operate at low voltage is
(a) GM counter (b) solid state detector
(c) Wilson cloud chamber (d) bubble chamber

15. The most useful tracer isotope is
(a) carbon-14 (b) cobalt-60 (c) iodine-131 (d) stronsium-90

16. Photons of energy more than 0.5 MeV can produce
(a) pair production (b) compton's effect
(c) photoelectric effect (d) Fission process

Answers Key:

1.	(c) Decreases by 4, decreases by 2	9.	(b) Chadwick
2.	(b) $\frac{15N}{16}$	10.	(d) all of these
3.	(b) Chadwick	11.	(a) meson
4.	(b) 6	12.	(a) electromagnetic and weak forces
5.	(b) Increases by 1	13.	(d) quarks
6.	(c) Photons	14.	(b) solid state detector
7.	(c) 2	15.	(a) carbon-14
8.	(c) 6.4 MeV	16.	(c) photoelectric effect

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PHYSICS PART – II

Note:- You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

Q.1	Questions	(A)	(B)	(C)	(D)
1.	When some dielectric is inserted between the plates of a capacitor, then	Charge remain constant	Potential decreases	Capacitance increases	All of these
2.	A charge of 1 μc experiences a force of 10^{-6} N at a point then the electric intensity at that point is	10^{6} N/C	10^{-6} N/C	10^{-12} N/C	1 N/C
3.	Temperature coefficient of resistivity of a material is measured in	Ω – K	Ω – m	K^{-1}	K
4.	The galvanometer in which the coil comes to rest quickly after the current passed through it, is called as	Stable Galvanometer	Dead beat Galvanometer	Both A & B	Sensitive Galvanometer
5.	In CRO, the number of electrons is controlled by operating	Anodes	Cathodes	Grid	Filament
6.	A transformer steps 220 V to 40 V. If secondary turns are 40 then primary turns are	20	40	120	220
7.	In RLC Series circuit, at low frequency	$X_C < X_L$	$X_C > X_L$	$X_C = X_L$	None of these
8.	The electric or magnetic field does not radiate in space whenever a charge is	At rest	Moving with uniform velocity	Either of these	None of these
9.	When a ferromagnetic substance is heated to a temperature above its curie temperature, it	Behaves like a paramagnetic substance	Behaves like a diamagnetic substance	Remains ferromagnetic substance	Is permanently magnetized
10.	In electromagnetic induction, the induced *emf* is independent of	Change of magnetic flux	time	number of turns	resistance of coil
11.	The reverse current in a pn-junction flows due to	Minority	Majority	Both A & B	None of th[illegible]

MDCAT BY FUTURE DOCTORS

TOUSEEF AHMAD

NMDCAT PREPARATION